

The R package *trioClasses* for definition of the class *SNPTrioExperiment*, an extension of *SummarizedExperiment*, for use in trio based analyses of genetic data.

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March 5, 2013

1 Classes

1.1 SnpMatrix, DataFrame, GRanges

The four key ingredients are the SNP matrix, the pedigree information as a DataFrame, position of the SNPs given by a GRanges object, and covariate data given as a DataFrame.

```
> sm
```

```
A SnpMatrix with 968 rows and 511 columns
```

```
Row names: H_ME-DS10776_2-DS10776_2 ... H_ME-DS11313_1-DS11313_1
```

```
Col names: chr14:54383433 ... chr14:54444750
```

```
> ped.DF
```

```
DataFrame with 4139 rows and 6 columns
```

	famid	id
	<character>	<character>
1	4778	H_ME-4778_1-4778_1.2
2	4778	H_ME-4778_2-4778_2.2
3	4778	H_ME-4778_3-4778_3.2
4	4783	H_ME-4783_1-4783_1.1
5	4783	H_ME-4783_2-4783_2.1
6	4783	H_ME-4783_3-4783_3.1
7	20000492	H_ME-20000492_1-20000492_1.1
8	20000492	H_ME-20000492_2-20000492_2.a.1
9	20000492	H_ME-20000492_3-20000492_3.1
...
4131	DS12332	H_ME-DS12332_1-DS12332_1
4132	DS12332	H_ME-DS12332_2-DS12332_2
4133	DS12332	H_ME-DS12332_3-DS12332_3
4134	DS99998	H_ME-DS10193_5-DS10193_5.2
4135	DS99998	H_ME-DS10193_6-DS10193_6
4136	DS99998	H_ME-DS10193_7-DS10193_7
4137	DS99999	H_ME-DS10707_4-DS10707_4.2
4138	DS99999	H_ME-DS10707_5-DS10707_5

```

4139      DS99999      H_ME-DS10707_6-DS10707_6
                                fid      mid
                                <character>      <character>
1      H_ME-4778_2-4778_2.2      H_ME-4778_3-4778_3.2
2      NA      NA
3      NA      NA
4      H_ME-4783_2-4783_2.1      H_ME-4783_3-4783_3.1
5      NA      NA
6      NA      NA
7      H_ME-20000492_2-20000492_2_a.1      H_ME-20000492_3-20000492_3.1
8      NA      NA
9      NA      NA
...      ...
4131      H_ME-DS12332_2-DS12332_2      H_ME-DS12332_3-DS12332_3
4132      NA      NA
4133      NA      NA
4134      H_ME-DS10193_6-DS10193_6      H_ME-DS10193_7-DS10193_7
4135      NA      NA
4136      NA      NA
4137      NA      NA
4138      H_ME-DS10707_4-DS10707_4.2      H_ME-DS10707_6-DS10707_6
4139      NA      NA
                                sex      dx
                                <numeric> <numeric>
1      1      1
2      1      0
3      2      0
4      2      1
5      1      0
6      2      1
7      2      1
8      1      0
9      2      0
...      ...
4131      1      1
4132      1      0
4133      2      0
4134      2      1
4135      1      0
4136      2      0
4137      1      0
4138      1      1
4139      2      0

```

```
> gr
```

GRanges with 511 ranges and 0 metadata columns:

```

      seqnames      ranges strand
      <Rle>      <IRanges> <Rle>
chr14:54383433      chr14      [1, 1]      *
chr14:54383470      chr14      [2, 2]      *
chr14:54383819      chr14      [3, 3]      *

```

```

chr14:54383945    chr14    [4, 4]    *
chr14:54384030    chr14    [5, 5]    *
chr14:54384232    chr14    [6, 6]    *
chr14:54384251    chr14    [7, 7]    *
chr14:54384291    chr14    [8, 8]    *
chr14:54384382    chr14    [9, 9]    *
...              ...              ...
chr14:54443495    chr14 [503, 503]    *
chr14:54443499    chr14 [504, 504]    *
chr14:54443514    chr14 [505, 505]    *
chr14:54443831    chr14 [506, 506]    *
chr14:54443880    chr14 [507, 507]    *
chr14:54444016    chr14 [508, 508]    *
chr14:54444124    chr14 [509, 509]    *
chr14:54444385    chr14 [510, 510]    *
chr14:54444750    chr14 [511, 511]    *
---
seqlengths:
chr14
NA

```

1.2 SummarizedExperiment

We combine three of the key ingredients when we create the SummarizedExperiment object.

```

> se <- SummarizedExperiment(assays = SimpleList(geno = t(sm)),
  colData = col.DF, rowData = gr)

```

1.3 SNP Trio Experiment

Now, we include the pedigree information as an object of class PedClass. We keep PedClass independent of SNP Trio Experiment for flexibility.

```

> ped <- PedClass(ped.DF)
> ste <- SNP Trio Experiment(se, pedigree = ped)

```

Here is the show method.

```

> ste

class: SNP Trio Experiment
dim: 511 968
exptData(0):
assays(1): geno
rownames(511): chr14:54383433 chr14:54383470 ...
  chr14:54444385 chr14:54444750
rowData metadata column names(0):
colnames(968): H_ME-CSc175_1-CSc175_1_a.1
  H_ME-CSc175_2-CSc175_2 ... H_ME-DS11418_2-DS11418_2
  H_ME-DS11418_3-DS11418_3
colData names(28): vcfid jb_famid ... id ped
pedigree(4139): famid id fid mid sex dx

```

And now we verify that it is indeed an extension of SummarizedExperiment.

```
> getClass("SNPTrioExperiment")

Class "SNPTrioExperiment" [package "trioClasses"]

Slots:

Name:                pedigree                exptData
Class:                PedClass                SimpleList

Name:                rowData                colData
Class: GenomicRangesORGRangesList          DataFrame

Name:                assays
Class:                Assays

Extends: "SummarizedExperiment"
```

1.4 PedClass

Now we investigate the pedigree slot of the SNPTrioExperiment object.

```
> class(pedigree(ste))

[1] "PedClass"
attr(,"package")
[1] "trioClasses"

> getClass("PedClass")

Class "PedClass" [package "trioClasses"]

Slots:

Name:                rownames                nrows                listData
Class: characterORNULL                integer                list

Name:                elementType elementMetadata                metadata
Class:                character DataTableORNULL                list

Extends:
Class "DataFrame", directly
Class "DataTable", by class "DataFrame", distance 2
Class "SimpleList", by class "DataFrame", distance 2
Class "DataTableORNULL", by class "DataFrame", distance 3
Class "List", by class "DataFrame", distance 3
Class "Vector", by class "DataFrame", distance 4
Class "Annotated", by class "DataFrame", distance 5

> pedigree(ste)
```

PedClass with 4139 rows and 6 columns

	famid		id
	<factor>		<factor>
1	4778	H_ME-4778_1-4778_1.2	
2	4778	H_ME-4778_2-4778_2.2	
3	4778	H_ME-4778_3-4778_3.2	
4	4783	H_ME-4783_1-4783_1.1	
5	4783	H_ME-4783_2-4783_2.1	
6	4783	H_ME-4783_3-4783_3.1	
7	20000492	H_ME-20000492_1-20000492_1.1	
8	20000492	H_ME-20000492_2-20000492_2.a.1	
9	20000492	H_ME-20000492_3-20000492_3.1	
...	
4131	DS12332	H_ME-DS12332_1-DS12332_1	
4132	DS12332	H_ME-DS12332_2-DS12332_2	
4133	DS12332	H_ME-DS12332_3-DS12332_3	
4134	DS99998	H_ME-DS10193_5-DS10193_5.2	
4135	DS99998	H_ME-DS10193_6-DS10193_6	
4136	DS99998	H_ME-DS10193_7-DS10193_7	
4137	DS99999	H_ME-DS10707_4-DS10707_4.2	
4138	DS99999	H_ME-DS10707_5-DS10707_5	
4139	DS99999	H_ME-DS10707_6-DS10707_6	
		fid	mid
		<factor>	<factor>
1		H_ME-4778_2-4778_2.2	H_ME-4778_3-4778_3.2
2		NA	NA
3		NA	NA
4		H_ME-4783_2-4783_2.1	H_ME-4783_3-4783_3.1
5		NA	NA
6		NA	NA
7	H_ME-20000492_2-20000492_2.a.1	H_ME-20000492_3-20000492_3.1	
8		NA	NA
9		NA	NA
...	
4131		H_ME-DS12332_2-DS12332_2	H_ME-DS12332_3-DS12332_3
4132		NA	NA
4133		NA	NA
4134		H_ME-DS10193_6-DS10193_6	H_ME-DS10193_7-DS10193_7
4135		NA	NA
4136		NA	NA
4137		NA	NA
4138		H_ME-DS10707_4-DS10707_4.2	H_ME-DS10707_6-DS10707_6
4139		NA	NA
	sex	dx	
	<factor>	<factor>	
1	1	1	
2	1	0	
3	2	0	
4	2	1	
5	1	0	
6	2	1	

```

7          2          1
8          1          0
9          2          0
...      ...      ...
4131       1          1
4132       1          0
4133       2          0
4134       2          1
4135       1          0
4136       2          0
4137       1          0
4138       1          1
4139       2          0

```

1.5 geno accessor

```

> class(geno(ste))

[1] "SnpMatrix"
attr("package")
[1] "snpStats"

> getClass("SnpMatrix")

Class "SnpMatrix" [package "snpStats"]

Slots:

Name:      .Data
Class: matrix

Extends:
Class "matrix", from data part
Class "array", by class "matrix", distance 2
Class "mMatrix", by class "matrix", distance 2
Class "structure", by class "matrix", distance 3
Class "vector", by class "matrix", distance 4, with explicit coerce

Known Subclasses: "XSnpMatrix"

> geno(ste)

A SnpMatrix with 968 rows and 511 columns
Row names:  H_ME-CSc175_1-CSc175_1_a.1 ... H_ME-DS11418_3-DS11418_3
Col names:  chr14:54383433 ... chr14:54444750

```

1.6 RowData

```

> rowData(ste)

GRanges with 511 ranges and 0 metadata columns:
      seqnames      ranges strand

```

	<Rle>	<IRanges>	<Rle>
chr14:54383433	chr14	[1, 1]	*
chr14:54383470	chr14	[2, 2]	*
chr14:54383819	chr14	[3, 3]	*
chr14:54383945	chr14	[4, 4]	*
chr14:54384030	chr14	[5, 5]	*
chr14:54384232	chr14	[6, 6]	*
chr14:54384251	chr14	[7, 7]	*
chr14:54384291	chr14	[8, 8]	*
chr14:54384382	chr14	[9, 9]	*
...
chr14:54443495	chr14	[503, 503]	*
chr14:54443499	chr14	[504, 504]	*
chr14:54443514	chr14	[505, 505]	*
chr14:54443831	chr14	[506, 506]	*
chr14:54443880	chr14	[507, 507]	*
chr14:54444016	chr14	[508, 508]	*
chr14:54444124	chr14	[509, 509]	*
chr14:54444385	chr14	[510, 510]	*
chr14:54444750	chr14	[511, 511]	*

seqlengths:
chr14
NA

1.7 ColData

```
> colData(ste)
```

DataFrame with 968 rows and 28 columns

	vcfid	jb_famid
	<character>	<character>
H_ME-CSc175_1-CSc175_1_a.1	H_ME-CSc175_1-CSc175_1_a.1	CSc175
H_ME-CSc175_2-CSc175_2	H_ME-CSc175_2-CSc175_2	CSc175
H_ME-CSc175_3-CSc175_3	H_ME-CSc175_3-CSc175_3	CSc175
H_ME-DS10776_1-DS10776_1	H_ME-DS10776_1-DS10776_1	DS10776
H_ME-DS10776_2-DS10776_2	H_ME-DS10776_2-DS10776_2	DS10776
H_ME-DS10776_3-DS10776_3	H_ME-DS10776_3-DS10776_3	DS10776
H_ME-DS10777_1-DS10777_1	H_ME-DS10777_1-DS10777_1	DS10777
H_ME-DS10777_2-DS10777_2	H_ME-DS10777_2-DS10777_2	DS10777
H_ME-DS10777_3-DS10777_3	H_ME-DS10777_3-DS10777_3	DS10777
...
H_ME-DS11399_3-DS11399_3	H_ME-DS11399_3-DS11399_3	DS11399
H_ME-DS11408_2-DS11408_2	H_ME-DS11408_2-DS11408_2	DS11408
H_ME-DS11408_3-DS11408_3	H_ME-DS11408_3-DS11408_3	DS11408
H_ME-DS11411_1-DS11411_1	H_ME-DS11411_1-DS11411_1	DS11411
H_ME-DS11411_2-DS11411_2	H_ME-DS11411_2-DS11411_2	DS11411
H_ME-DS11411_3-DS11411_3	H_ME-DS11411_3-DS11411_3	DS11411
H_ME-DS11418_1-DS11418_1	H_ME-DS11418_1-DS11418_1	DS11418
H_ME-DS11418_2-DS11418_2	H_ME-DS11418_2-DS11418_2	DS11418
H_ME-DS11418_3-DS11418_3	H_ME-DS11418_3-DS11418_3	DS11418

	jb_indid	jb_fatherid	jb_motherid
	<character>	<character>	<character>
H_ME-CSc175_1-CSc175_1_a.1	CSc175_01	CSc175_02	CSc175_03
H_ME-CSc175_2-CSc175_2	CSc175_02	0	0
H_ME-CSc175_3-CSc175_3	CSc175_03	0	0
H_ME-DS10776_1-DS10776_1	DS10776_01	DS10776_02	DS10776_03
H_ME-DS10776_2-DS10776_2	DS10776_02	0	0
H_ME-DS10776_3-DS10776_3	DS10776_03	0	0
H_ME-DS10777_1-DS10777_1	DS10777_01	DS10777_02	DS10777_03
H_ME-DS10777_2-DS10777_2	DS10777_02	0	0
H_ME-DS10777_3-DS10777_3	DS10777_03	0	0
...
H_ME-DS11399_3-DS11399_3	DS11399_03	0	0
H_ME-DS11408_2-DS11408_2	DS11408_02	0	0
H_ME-DS11408_3-DS11408_3	DS11408_03	0	0
H_ME-DS11411_1-DS11411_1	DS11411_01	DS11411_02	DS11411_03
H_ME-DS11411_2-DS11411_2	DS11411_02	0	0
H_ME-DS11411_3-DS11411_3	DS11411_03	0	0
H_ME-DS11418_1-DS11418_1	DS11418_01	DS11418_02	DS11418_03
H_ME-DS11418_2-DS11418_2	DS11418_02	0	0
H_ME-DS11418_3-DS11418_3	DS11418_03	0	0
	jb_gender	jb_affection	ts_famid
	<numeric>	<numeric>	<character>
H_ME-CSc175_1-CSc175_1_a.1	2	1	CSc175
H_ME-CSc175_2-CSc175_2	1	0	CSc175
H_ME-CSc175_3-CSc175_3	2	0	CSc175
H_ME-DS10776_1-DS10776_1	2	1	DS10776
H_ME-DS10776_2-DS10776_2	1	1	DS10776
H_ME-DS10776_3-DS10776_3	2	0	DS10776
H_ME-DS10777_1-DS10777_1	2	1	DS10777
H_ME-DS10777_2-DS10777_2	1	0	DS10777
H_ME-DS10777_3-DS10777_3	2	0	DS10777
...
H_ME-DS11399_3-DS11399_3	2	0	DS11399
H_ME-DS11408_2-DS11408_2	1	0	DS11408
H_ME-DS11408_3-DS11408_3	2	0	DS11408
H_ME-DS11411_1-DS11411_1	1	1	DS11411
H_ME-DS11411_2-DS11411_2	1	0	DS11411
H_ME-DS11411_3-DS11411_3	2	0	DS11411
H_ME-DS11418_1-DS11418_1	1	1	DS11418
H_ME-DS11418_2-DS11418_2	1	0	DS11418
H_ME-DS11418_3-DS11418_3	2	0	DS11418
	ts_indid	ts_sampleid	ts_fatherid
	<character>	<character>	<character>
H_ME-CSc175_1-CSc175_1_a.1	CSc175_1	CSc175_1_a.1	CSc175_2
H_ME-CSc175_2-CSc175_2	CSc175_2	CSc175_2_a.3	NA
H_ME-CSc175_3-CSc175_3	CSc175_3	CSc175_3	NA
H_ME-DS10776_1-DS10776_1	DS10776_1	DS10776_1	DS10776_2
H_ME-DS10776_2-DS10776_2	DS10776_2	DS10776_2	NA
H_ME-DS10776_3-DS10776_3	DS10776_3	DS10776_3	NA
H_ME-DS10777_1-DS10777_1	DS10777_1	DS10777_1	DS10777_2

H_ME-DS10777_2-DS10777_2	DS10777_2	DS10777_2	NA
H_ME-DS10777_3-DS10777_3	DS10777_3	DS10777_3	NA
...
H_ME-DS11399_3-DS11399_3	DS11399_3	DS11399_3	NA
H_ME-DS11408_2-DS11408_2	DS11408_2	DS11408_2	NA
H_ME-DS11408_3-DS11408_3	DS11408_3	DS11408_3	NA
H_ME-DS11411_1-DS11411_1	DS11411_1	DS11411_1	DS11411_2
H_ME-DS11411_2-DS11411_2	DS11411_2	DS11411_2	NA
H_ME-DS11411_3-DS11411_3	DS11411_3	DS11411_3	NA
H_ME-DS11418_1-DS11418_1	DS11418_1	DS11418_1	DS11418_2
H_ME-DS11418_2-DS11418_2	DS11418_2	DS11418_2	NA
H_ME-DS11418_3-DS11418_3	DS11418_3	DS11418_3	NA
	ts_motherid	ts_gender	ts_pheno
	<character>	<character>	<character>
H_ME-CSc175_1-CSc175_1_a.1	CSc175_3	Female	CLP
H_ME-CSc175_2-CSc175_2	NA	Male	NA
H_ME-CSc175_3-CSc175_3	NA	Female	NA
H_ME-DS10776_1-DS10776_1	DS10776_3	Female	CL
H_ME-DS10776_2-DS10776_2	NA	Male	CL
H_ME-DS10776_3-DS10776_3	NA	Female	NA
H_ME-DS10777_1-DS10777_1	DS10777_3	Female	CL
H_ME-DS10777_2-DS10777_2	NA	Male	NA
H_ME-DS10777_3-DS10777_3	NA	Female	NA
...
H_ME-DS11399_3-DS11399_3	NA	Female	NA
H_ME-DS11408_2-DS11408_2	NA	Male	NA
H_ME-DS11408_3-DS11408_3	NA	Female	NA
H_ME-DS11411_1-DS11411_1	DS11411_3	Male	CL
H_ME-DS11411_2-DS11411_2	NA	Male	NA
H_ME-DS11411_3-DS11411_3	NA	Female	NA
H_ME-DS11418_1-DS11418_1	DS11418_3	Male	CLP
H_ME-DS11418_2-DS11418_2	NA	Male	NA
H_ME-DS11418_3-DS11418_3	NA	Female	NA
	dna	ethnicity	race
	<numeric>	<character>	<character>
H_ME-CSc175_1-CSc175_1_a.1	1	european	white
H_ME-CSc175_2-CSc175_2	1	european	white
H_ME-CSc175_3-CSc175_3	1	european	white
H_ME-DS10776_1-DS10776_1	1	european	White
H_ME-DS10776_2-DS10776_2	1	european	White
H_ME-DS10776_3-DS10776_3	1	european	White
H_ME-DS10777_1-DS10777_1	1	european	White
H_ME-DS10777_2-DS10777_2	1	european	White
H_ME-DS10777_3-DS10777_3	1	european	White
...
H_ME-DS11399_3-DS11399_3	1	european	Caucasian
H_ME-DS11408_2-DS11408_2	1	european	Caucasian
H_ME-DS11408_3-DS11408_3	1	european	Caucasian
H_ME-DS11411_1-DS11411_1	1	european	Caucasian
H_ME-DS11411_2-DS11411_2	1	european	Caucasian
H_ME-DS11411_3-DS11411_3	1	european	Caucasian

H_ME-DS11418_1-DS11418_1	1	European	Caucasian
H_ME-DS11418_2-DS11418_2	1	European	Caucasian
H_ME-DS11418_3-DS11418_3	1	European	Caucasian
	population	pi	gwasid
	<character>	<character>	<character>
H_ME-CSc175_1-CSc175_1_a.1	IOWA	Murray	13046_01
H_ME-CSc175_2-CSc175_2	IOWA	Murray	13046_03
H_ME-CSc175_3-CSc175_3	IOWA	Murray	13046_02
H_ME-DS10776_1-DS10776_1	TURKEY	Marazita	NA
H_ME-DS10776_2-DS10776_2	TURKEY	Marazita	NA
H_ME-DS10776_3-DS10776_3	TURKEY	Marazita	NA
H_ME-DS10777_1-DS10777_1	TURKEY	Marazita	NA
H_ME-DS10777_2-DS10777_2	TURKEY	Marazita	NA
H_ME-DS10777_3-DS10777_3	TURKEY	Marazita	NA
...
H_ME-DS11399_3-DS11399_3	DENMARK	Marazita	NA
H_ME-DS11408_2-DS11408_2	DENMARK	Marazita	NA
H_ME-DS11408_3-DS11408_3	DENMARK	Marazita	NA
H_ME-DS11411_1-DS11411_1	DENMARK	Marazita	NA
H_ME-DS11411_2-DS11411_2	DENMARK	Marazita	NA
H_ME-DS11411_3-DS11411_3	DENMARK	Marazita	NA
H_ME-DS11418_1-DS11418_1	DENMARK	Marazita	NA
H_ME-DS11418_2-DS11418_2	DENMARK	Marazita	NA
H_ME-DS11418_3-DS11418_3	DENMARK	Marazita	NA
	twin	X_merge	affected
	<character>	<character>	<numeric>
H_ME-CSc175_1-CSc175_1_a.1	NA	matched (3)	1
H_ME-CSc175_2-CSc175_2	NA	matched (3)	0
H_ME-CSc175_3-CSc175_3	NA	matched (3)	0
H_ME-DS10776_1-DS10776_1	NA	matched (3)	1
H_ME-DS10776_2-DS10776_2	NA	matched (3)	1
H_ME-DS10776_3-DS10776_3	NA	matched (3)	0
H_ME-DS10777_1-DS10777_1	NA	matched (3)	1
H_ME-DS10777_2-DS10777_2	NA	matched (3)	0
H_ME-DS10777_3-DS10777_3	NA	matched (3)	0
...
H_ME-DS11399_3-DS11399_3	NA	matched (3)	0
H_ME-DS11408_2-DS11408_2	NA	matched (3)	0
H_ME-DS11408_3-DS11408_3	NA	matched (3)	0
H_ME-DS11411_1-DS11411_1	Dizygotic	matched (3)	1
H_ME-DS11411_2-DS11411_2	NA	matched (3)	0
H_ME-DS11411_3-DS11411_3	NA	matched (3)	0
H_ME-DS11418_1-DS11418_1	Dizygotic	matched (3)	1
H_ME-DS11418_2-DS11418_2	NA	matched (3)	0
H_ME-DS11418_3-DS11418_3	NA	matched (3)	0
	sex	mid	
	<numeric>	<character>	
H_ME-CSc175_1-CSc175_1_a.1	2	H_ME-CSc175_3-CSc175_3	
H_ME-CSc175_2-CSc175_2	1	NA	
H_ME-CSc175_3-CSc175_3	2	NA	
H_ME-DS10776_1-DS10776_1	2	H_ME-DS10776_3-DS10776_3	

H_ME-DS10776_2-DS10776_2	1	NA
H_ME-DS10776_3-DS10776_3	2	NA
H_ME-DS10777_1-DS10777_1	2	H_ME-DS10777_3-DS10777_3
H_ME-DS10777_2-DS10777_2	1	NA
H_ME-DS10777_3-DS10777_3	2	NA
...
H_ME-DS11399_3-DS11399_3	2	NA
H_ME-DS11408_2-DS11408_2	1	NA
H_ME-DS11408_3-DS11408_3	2	NA
H_ME-DS11411_1-DS11411_1	1	H_ME-DS11411_3-DS11411_3
H_ME-DS11411_2-DS11411_2	1	NA
H_ME-DS11411_3-DS11411_3	2	NA
H_ME-DS11418_1-DS11418_1	1	H_ME-DS11418_3-DS11418_3
H_ME-DS11418_2-DS11418_2	1	NA
H_ME-DS11418_3-DS11418_3	2	NA

	fid	
	<character>	
H_ME-CSc175_1-CSc175_1_a.1	H_ME-CSc175_2-CSc175_2	
H_ME-CSc175_2-CSc175_2	NA	
H_ME-CSc175_3-CSc175_3	NA	
H_ME-DS10776_1-DS10776_1	H_ME-DS10776_2-DS10776_2	
H_ME-DS10776_2-DS10776_2	NA	
H_ME-DS10776_3-DS10776_3	NA	
H_ME-DS10777_1-DS10777_1	H_ME-DS10777_2-DS10777_2	
H_ME-DS10777_2-DS10777_2	NA	
H_ME-DS10777_3-DS10777_3	NA	
...	...	
H_ME-DS11399_3-DS11399_3	NA	
H_ME-DS11408_2-DS11408_2	NA	
H_ME-DS11408_3-DS11408_3	NA	
H_ME-DS11411_1-DS11411_1	H_ME-DS11411_2-DS11411_2	
H_ME-DS11411_2-DS11411_2	NA	
H_ME-DS11411_3-DS11411_3	NA	
H_ME-DS11418_1-DS11418_1	H_ME-DS11418_2-DS11418_2	
H_ME-DS11418_2-DS11418_2	NA	
H_ME-DS11418_3-DS11418_3	NA	
	id	ped
	<character>	<character>
H_ME-CSc175_1-CSc175_1_a.1	H_ME-CSc175_1-CSc175_1_a.1	CSc175
H_ME-CSc175_2-CSc175_2	H_ME-CSc175_2-CSc175_2	CSc175
H_ME-CSc175_3-CSc175_3	H_ME-CSc175_3-CSc175_3	CSc175
H_ME-DS10776_1-DS10776_1	H_ME-DS10776_1-DS10776_1	DS10776
H_ME-DS10776_2-DS10776_2	H_ME-DS10776_2-DS10776_2	DS10776
H_ME-DS10776_3-DS10776_3	H_ME-DS10776_3-DS10776_3	DS10776
H_ME-DS10777_1-DS10777_1	H_ME-DS10777_1-DS10777_1	DS10777
H_ME-DS10777_2-DS10777_2	H_ME-DS10777_2-DS10777_2	DS10777
H_ME-DS10777_3-DS10777_3	H_ME-DS10777_3-DS10777_3	DS10777
...
H_ME-DS11399_3-DS11399_3	H_ME-DS11399_3-DS11399_3	DS11399
H_ME-DS11408_2-DS11408_2	H_ME-DS11408_2-DS11408_2	DS11408
H_ME-DS11408_3-DS11408_3	H_ME-DS11408_3-DS11408_3	DS11408

H_ME-DS11411_1-DS11411_1	H_ME-DS11411_1-DS11411_1	DS11411
H_ME-DS11411_2-DS11411_2	H_ME-DS11411_2-DS11411_2	DS11411
H_ME-DS11411_3-DS11411_3	H_ME-DS11411_3-DS11411_3	DS11411
H_ME-DS11418_1-DS11418_1	H_ME-DS11418_1-DS11418_1	DS11418
H_ME-DS11418_2-DS11418_2	H_ME-DS11418_2-DS11418_2	DS11418
H_ME-DS11418_3-DS11418_3	H_ME-DS11418_3-DS11418_3	DS11418

2 Validity

3 Methods