

# Package ‘BackToSchool’

December 12, 2020

**Title** What the Package Does (One Line, Title Case)

**Version** 0.0.0.9000

**Description** What the package does (one paragraph).

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initialize_school	<i>Initialize school</i>
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## Description

This function takes in a data frame exported by `make_school()`. It adds epidemiological attributes of the full school community.

## Usage

```
initialize_school(
  n_contacts = 10,
  n_contacts_brief = 0,
  rel_trans_HH = 1,
  rel_trans = 1/8,
  rel_trans_brief = 1/50,
  p_asymp_adult = 0.35,
  p_asymp_child = 0.7,
  attack = 0.01,
  child_trans = 1,
  child_susp = 0.5,
  teacher_trans = 1,
  teacher_susp = 1,
  disperse_transmission = T,
  isolate = T,
  dedens = T,
  run_specials = F,
  start
)
```

## Arguments

<code>n_contacts</code>	Number of sustained contacts outside of the classroom; defaults to 10
<code>n_contacts_brief</code>	Number of brief contacts outside of the classroom; defaults to 0
<code>rel_trans_HH</code>	Relative attack rate of household contact (vs. classroom); defaults to 1
<code>rel_trans</code>	Relative attack rate of sustained contact (vs. classroom); defaults to 1/8
<code>rel_trans_brief</code>	Relative attack rate of brief contact (vs. classroom); defaults to 1/50
<code>p_asymp_adult</code>	Fraction of adults with asymptomatic (unsuspected) disease; defaults to 0.35
<code>p_asymp_child</code>	Fraction of children with asymptomatic (unsuspected) disease; defaults to 0.7
<code>attack</code>	Average daily attack rate in adults; defaults to 0.01
<code>child_trans</code>	Relative transmissibility of children (vs. adults); defaults to 1
<code>child_susp</code>	Relative transmissibility of children (vs. adults); defaults to .5
<code>teacher_trans</code>	Factor by which teacher transmissibility is reduced due to intervention; defaults to 1
<code>teacher_susp</code>	Factor by which teacher transmissibility is reduced due to intervention; defaults to 1

disperse_transmission	Whether transmission is overdispersed (vs. all have equal attack rate); default to T
isolate	Whether symptomatic individuals isolate when symptoms emerge; defaults to T
dedens	Whether dedensification measures reduce attack rate; defaults to F
run_specials	Whether special subjects are run; defaults to F
start	Data frame from make_class()

**Value**

out data frame of child and teacher attributes.

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make_infected	<i>Set infection parameters</i>
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---

**Description**

Set infection parameters for individuals infected at a particular timestep

**Usage**

```
make_infected(df.u, days_inf, set = NA, mult_asymp = 1, seed_asymp = F)
```

**Arguments**

set	indication of seeding model vs. creating infections
mult_asymp	multiplier on asymptomatic infection; default is 1
seed_asymp	when making a seed, force to be asymptomatic; default is false
a	id of infected individual
df	school data frame from make_school()

**Value**

df.u with updated parameters

---

make_quarantine	<i>Update quarantine</i>
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### Description

Mark classes for quarantine based on current symptomatic infections

### Usage

```
make_quarantine(
  class_quarantine,
  df.u,
  quarantine.length = 14,
  quarantine.grace = 3,
  hs = F,
  hs.classes = NA
)
```

### Arguments

class_quarantine	data frame of quarantine times
df.u	data frame of infections whose classes should be quarantined

### Value

class\_quarantine updated

---

make_schedule	<i>Make schedule</i>
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### Description

Make a schedule of when individuals in the school community are present/absent

### Usage

```
make_schedule(time = 30, type = "base", total_days = 5, df)
```

### Arguments

time	number of days; defaults to 30
type	"base", "On/off", "A/B", "Remote"; defaults to "base"
total_days	number of days in school; defaults to 5
df	data frame from make_school()

### Value

d Returns a n x time data frame that indicates whether an individual is in the school building at a particular time

---

make_school	<i>Make school</i>
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---

### Description

This function allows you to sort a synthetic population into classes. It also assigns children to groups for alternating schedules and ensures that children are in the same group as siblings. It adds non-primary teacher staff, and if families are included, includes two adult family members per child and one per adult staff member.

### Usage

```
make_school(
  synthpop = synthMaryland,
  n_other_adults = 30,
  includeFamily = F,
  n_class = 4
)
```

### Arguments

synthpop	synthetic population; defaults to synthMaryland stored in file
n_other_adults	Number of adults in the school other than primary teachers; defaults to 30
includeFamily	whether to include family and adult family members of teachers, default = FALSE
n_class	number of classes per grade

### Value

out data frame of child and teacher attributes

---

mult_runs	<i>Run model multiple times and summarize results</i>
-----------	---

---

### Description

Run model multiple times and summarize results

### Usage

```
mult_runs(
  N = 500,
  n_other_adults = 30,
  n_contacts = 10,
  n_contacts_brief = 0,
  rel_trans_HH = 1,
  rel_trans = 1/8,
  rel_trans_brief = 1/50,
  rel_trans_CC = 2,
```

```

rel_trans_adult = 2,
p_asymp_adult = 0.35,
child_prob = 0.05,
adult_prob = 0.01,
p_asymp_child = 0.8,
attack = 0.01,
child_trans = 1,
child_susp = 0.5,
teacher_trans = 1,
teacher_susp = 1,
disperse_transmission = T,
n_staff_contact = 0,
n_HH = 0,
num_adults = 2,
n_start = 1,
time_seed_inf = NA,
days_inf = 6,
mult_asymp = 1,
seed_asymp = F,
isolate = T,
dedens = 0,
run_specials_now = F,
time = 30,
notify = F,
test = F,
test_sens = 0.7,
test_frac = 0.9,
test_days = "week",
test_type = "all",
quarantine.length = 14,
quarantine.grace = 3,
type = "base",
total_days = 5,
includeFamily = T,
synthpop = synthMaryland,
class = NA,
n_class = 4,
high_school = F,
nper = 8,
start_mult = 1,
start_type = "mix",
bubble = F,
no_weekends = F
)

```

### Arguments

N	number of runs
n_other_adults	Number of adults in the school other than primary teachers; defaults to 30
n_contacts	Number of sustained contacts outside of the classroom; defaults to 10
n_contacts_brief	Number of brief contacts outside of the classroom; defaults to 20

rel_trans_HH	Relative attack rate of household contact (vs. classrom); defaults to 1
rel_trans	Relative attack rate of sustained contact (vs. classroom); defaults to 1/8
rel_trans_brief	Relative attack rate of brief contact (vs. classroom); defaults to 1/50
p_asymp_adult	Fraction of adults with asymptomatic (unsuspected) disease; defaults to 0.35
child_prob	if start_type = "cont", set daily probability of infectious entry for children, defaults to .05
adult_prob	if start_type = "cont", set daily probability of infectious entry for adults, defaults to .01
p_asymp_child	Fraction of children with asymptomatic (unsuspected) disease; defaults to 0.7
attack	Average daily attack rate in adults; defaults to 0.01
child_trans	Relative transmissibility of children (vs. adults); defaults to 1
child_susp	Relative transmissibility of children (vs. adults); defaults to .5
teacher_trans	Factor by which teacher transmissibility is reduced due to intervention; defaults to 1
teacher_susp	Factor by which teacher transmissibility is reduced due to intervention; defaults to 1
disperse_transmission	Whether transmission is overdispersed (vs. all have equal attack rate); default to T
n_staff_contact	number of contacts a teacher/staff member has with other teachers/staff members; defaults to 1
n_HH	number of households a household interacts with when not attending school; defaults to 0
num_adults	number of adults interacting with children, defaults to 2
n_start	number of infections to seed model; defaults to 1
time_seed_inf	time(s) at which to introduce new infectious individuals; defaults to NA and randomly selects one time
days_inf	length of infectious period (assuming mild case or quarantined on symptoms)
mult_asymp	multiplier on asymptomatic infection; default is 1
seed_asymp	whether to seed with an asymptomatic case
isolate	Whether symptomatic individuals isolate when symptoms emerge; defaults to T
dedens	Whether dedensification measures reduce attack rate; defaults to F
time	length of time to run model; defaults to 30
notify	whether classrooms are notified and quarantined; defaults to F
test	whether there is weekly testing; defaults to F
test_sens	test sensitivity; defaults to 0.7
test_frac	fraction of school tested; defaults to 0.9
test_days	vector indicating days on which students are tested; defaults to Sundays
test_type	group tested; defaults to "all", also allows "staff" and "students"
quarantine.length	length of quarantine when someone is infectious; defaults to 14

quarantine.grace	length of grace period after which a quarantined class returns not to be "re-quarantined"
type	"base", "On/off", "A/B", "Remote"; defaults to "base"
total_days	number of days in school; defaults to 5
includeFamily	whether to include family, default = FALSE
synthpop	synthetic population; defaults to synthMaryland
high_school	whether to use a high school schedule of random period mixing; defaults to F
nper	number of school periods; defaults to 8
start_mult	value to indicate relative frequency of adult/child infections; defaults to 1 (adults 2x as likely as kids)
bubble	whether out-of-school interactions occur with a 'bubble'; defaults to F
run_specials	Whether special subjects are run; defaults to F
@start_type	type of seed; default is "mix" (also "adult", "child")

---

results	<i>Summarize multiple runs</i>
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---

### Description

Summarize multiple runs

### Usage

```
results(out)
```

### Arguments

out	output from mult_runs
-----	-----------------------

### Value

calc summarizes results from multiple runsf

---

run_care	<i>Set care-based transmission</i>
----------	------------------------------------

---

### Description

Determine who is infected at a timestep from contact with an infected individual out of school

### Usage

```
run_care(a, df, care_contacts, rel_trans_CC = 2, num_adults = 2)
```



**Arguments**

a	id of infected individual
df	school data frame from make_school()
num_adults	number of adults interacting with children, defaults to 2
contacts	graph of random contacts at time t

**Value**

infs id of infected individuals

---

run_class	<i>Set class transmission</i>
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---

**Description**

Determine who is infected at a timestep in the same classroom as an infected individual

**Usage**

```
run_class(a, df, high_school = F, hs.classes = NA)
```

**Arguments**

a	id of infected individual
df	school data frame from make_school()

**Value**

infs id of infected individuals

---

run_household	<i>Set household transmission</i>
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---

**Description**

Determine who is infected at a timestep in the same household as an infected individual

**Usage**

```
run_household(a, df)
```

**Arguments**

a	id of infected individual
df	school data frame from make_school()

**Value**

infs id of infected individuals

run\_model

*Run model***Description**

Perform a single model run

**Usage**

```
run_model(
  time = 30,
  notify = F,
  test = F,
  test_days = "week",
  test_sens = 0.7,
  test_frac = 0.9,
  n_staff_contact = 0,
  n_HH = 0,
  n_start = 1,
  days_inf = 6,
  mult_asyp = 1,
  seed_asyp = F,
  time_seed_inf = NA,
  high_school = F,
  nper = 8,
  start_mult = 1,
  start_type = "mix",
  test_type = "all",
  adult_prob = 0.013,
  child_prob = 0.056,
  quarantine.length = 14,
  quarantine.grace = 3,
  rel_trans_CC = 2,
  rel_trans_adult = 2,
  num_adults = 2,
  bubble = F,
  no_weekends = F,
  df,
  sched
)
```

**Arguments**

time	length of time to run model; defaults to 30
notify	whether classrooms are notified and quarantined; defaults to F
test	whether there is weekly testing; defaults to F
test_sens	test sensitivity; defaults to 0.7
test_frac	fraction of school tested; defaults to 0.9

n_staff_contact	number of contacts a teacher/staff member has with other teachers/staff members; defaults to 1
n_HH	number of households a household interacts with when not attending school; defaults to 0
n_start	number of infections to seed model; defaults to 1
days_inf	length of infectious period (assuming mild case or quarantined on symptoms)
mult_asymp	multiplier on asymptomatic infection; default is 1
seed_asymp	whether to seed with an asymptomatic case
time_seed_inf	time(s) at which to introduce new infectious individuals; defaults to NA and randomly selects one time
high_school	whether to use a high school schedule of random period mixing; defaults to F
nper	number of school periods; defaults to 8
start_mult	value to indicate relative frequency of adult/child infections; defaults to 1 (adults 2x as likely as kids)
start_type	type of seed; default is "mix" (also "adult", "child", "cont")
test_type	group tested; defaults to "all", also allows "staff" and "students"
quarantine.length	length of quarantine when someone is infectious; defaults to 14
quarantine.grace	length of grace period after which a quarantined class returns not to be "re-quarantined"
num_adults	number of adults interacting with children, defaults to 2
bubble	whether out-of-school interactions occur with a 'bubble'; defaults to F
no_weekends	if TRUE excludes weekends from additional out-of-school mixing, defaults to F
df	school data frame from make_school()
sched	schedule data frame from make_schedule()

**Value**

df updated df with transmission results  
time\_seed\_inf when the first individual was dropped in  
class\_quarantine a matrix of class quarantine times  
mat a check on if the people who you think are present are actually the ones present

---

run_rand	<i>Set random transmission</i>
----------	--------------------------------

---

**Description**

Determine who is infected at a timestep from random contact with an infected individual

**Usage**

```
run_rand(a, df, random_contacts)
```

**Arguments**

a                      id of infected individual  
 df                     school data frame from make\_school()  
 random\_contacts      graph of random contacts at time t

**Value**

infs id of infected individuals

---

run_specials	<i>Set specials transmission</i>
--------------	----------------------------------

---

**Description**

Determine who is infected at a timestep from specials

**Usage**

```
run_specials(a, df, specials)
```

**Arguments**

a                      id of infected individual  
 df                     school data frame from make\_school()  
 specials              classroom and teacher ids of specials at time t

**Value**

infs id of infected individuals

---

run_staff_rand	<i>Set random staff transmission</i>
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---

**Description**

Determine who is infected at a timestep from random contact between in-school adults

**Usage**

```
run_staff_rand(a, df, n_contact, rel_trans_adult = 2)
```

**Arguments**

a                      id of infected individual  
 df                     school data frame from make\_school()  
 random\_contacts      graph of random contacts at time t

**Value**

infs id of infected individuals

---

`synthpop`*Synthetic Maryland elementary school population*

---

**Description**

A data frame containing a synthetic population of children ages 5-10, representative of the state of Maryland. This is used by `make_class()` to sort children into classes.

**Usage**

```
data(synthMaryland)
```

**Format**

A data frame with

**HH\_id** household ID

**age** age

**flag\_mult** true if more than one child in the household, not used

**id** individual id #

**Source**

Wheaton, W.D., U.S. Synthetic Population 2010 Version 1.0 Quick Start Guide, RTI International, May 2014. ([website](#)). Created with script `demographic_data2.R`.

---

`synthpop_HS`*Synthetic Maryland high school population*

---

**Description**

A data frame containing a synthetic population of children ages 14-17, representative of the state of Maryland. This is used by `make_class()` to sort children into classes.

**Usage**

```
data(synthMaryland_HS)
```

**Format**

A data frame with

**HH\_id** household ID

**age** age

**flag\_mult** true if more than one child in the household, not used

**id** individual id #

**Source**

Wheaton, W.D., U.S. Synthetic Population 2010 Version 1.0 Quick Start Guide, RTI International, May 2014. ([website](#)). Created with script `demographic_data2.R`.

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