Random

Random is a currency word in trials. It or the word *randomization* forms the basis for 100+ entries in the Clinical Trials Dictionary (Meinert, 1996).[1]

The word has magical properties. As a modifier, eg, as in *randomized trial*, it creates an aura of respectability and credibility akin to that of the Good Housekeeping Seal of Approval for things we buy. *Randomization* — the act of assigning persons to treatment according to some random process — is assumed to "ensure" the comparability of the treatment groups represented in the trial (*Randomization is also essential to ensure balance for any unknown as well as known confounders*[2]).

Random is of English, French, and German origins meaning to run. As a descriptor, *random* is used as a characterization of something having no specific pattern or objective, eg, as in *random* chatter.

Random and *haphazard* are used interchangeably in everyday discourse. *Haphazard* is listed as a synonym for *random* in *The American Heritage Dictionary* (2nd College Edition) and *Webster's Tenth New Collegiate Dictionary*. In the strict discourse of science the word is generally reserved for characterizing processes having an underlying known probability base. That base is lacking or unknown with haphazard processes. The fact that something lacks pattern or that it looks, feels, and smells like something random is not sufficient justification for use of the label if the user cannot identify the underlying probability function producing the result. Hence, a system of assignment based on order of arrival of patients at a clinic is *haphazard* but not *random*.

But there are exceptions. For example, in *random number generator*. The numbers coming from such generators look, feel, and smell like random numbers but the sequence is deterministic, generated by a "seed" (number arbitrarily specified by the user to start the sequence).

As noted above, the expectation is that randomization will produce treatment groups having comparable entry and baseline characteristics. Although the expectation is usually satisfied, there is no "guarantee" of comparability. Large differences in the treatment groups can occur by chance in the same way that one can have a long and fortuitous (or disastrous) run of luck at the blackjack table. Hence, an aberrantly small p-value for a given baseline difference does not, by itself, provide evidence of a "breakdown" (due to tampering, peeking, or other subversive acts to control the assignment process) of randomization. Large differences, indicated by small p-values, are to be expected by chance alone. If one wants a "guarantee" of comparability, one has to resort to stratification or other maneuvers.

The primary purpose of randomization is to avoid treatment-related selection bias.[3] The notion of bias free assignment is at the heart of any comparative trial and chance, via randomization, represents the best available tool for achieving bias-free assignment. That being the case, it is ironic that *random* remains one of the most abused terms in trials. The label is loosely applied to all manner of assignment schemes, sometimes even to systematic schemes dictated by day of arrival or the like. The blame for the abuse rests with authors and editors.

The intermingling of *random* and *haphazard* in everyday usage increases the chance of the intermingling in what trialists write. Study investigators who misuse the word in everyday talk (eg, by requesting *random blood sugar* determinations when, in fact, they mean haphazard blood sugar determinations) are likely to do so when they write as well. That risk plus the tendency, perhaps in us all, to use the language of flower and inflation when we write, means that many schemes, that, at best, are haphazard are described as random.

Editors have to accept their fair share of the blame in perpetuating the misuse. They are too willing to accept the word as a descriptor without supporting documentation. There is some hope for rehabilitation of the word with increasing emphasis placed on reporting requirements for trials. Proposed reporting standards[2,4,5] recognize the need for details regarding the assignment process. Those details, if provided, should allow readers to determine whether the word has been properly used.

random *adj, general* - [ME impetuosity, fr MF *randon*, fr OF, fr *randir*, to run, of Gmc origin, akin to OHG *rinnan* to run] 1. Having or appearing to have no specific pattern or objective. 2. Of or designating a **chance** process in which the occurrence of previous **events** is of no value in predicting future events. 3. **haphazard** syn: **chance**, **casual**, **haphazard** ***Usage note***: Avoid; use **haphazard**, **casual**, **chance**, or **quasirandom** to avoid confusion with **random** *adj, scientific*. See also note for **lottery**.

random *adj, scientific* - 1. Of or relating to a value, **observation**, **assignment**, arrangement, etc, that is the result of **chance**. 2. Of or relating to a **sequence**, **observation**, **assignment**, arrangement, etc, that is the result of a **chance** process in which the **probability** is known or can be determined. 3. Of or relating to a **pseudorandom** process that has the properties of one that is random. 4. Of or relating to a single value, observation, assignment, or arrangement that is the result of **randomization**. syn: **chance**, **lottery** (not recommended synonyms, except in lay usage, as in **consent statements** describing the **treatment assignment process**) ant: **nonrandom** rt: **pseudorandom**, **quasirandom** ***Usage note***: Subject to misuse. Avoid in the absence of a probability base (as in *random blood sugar* in reference to routine blood sugar determinations); use **haphazard** or some other term implying less rigor than does **random**. Misuse in the context of trials arises most commonly in relation to characterizations of treatment assignment schemes as **random** that are **systematic** or **haphazard**. See also note for **lottery**.

Other related words or terms

random assignment *n* - 1. **Assignment** or designation made using **randomization**. 2. An assignment that is the result of a **random process** or **pseudorandom process**. 3. **random treatment assignment** 4. **haphazard treatment assignment** ***Usage note***: Avoid in the sense of defn 4; see note for **random** *adj, scientific*.

randomize, **randomized**, **randomizing**, **randomizes** *v* - To arrange, order, mix, or assign by use of **randomization**. ant: **nonrandomized** rt: **random** ***Usage note***: See **random**.

randomized *n* - The condition of having been assigned to a **treatment** via a **random process**; normally considered to have occurred when the **treatment assignment** is revealed to any member of the clinic staff, eg, when an envelope containing the treatment is opened at the **clinic**.

randomized trial *n* - 1. **randomized controlled trial** 2. A trial involving **random treatment assignment**. 3. A trial involving **randomization** of **treatment**. ant: **nonrandomized trial** ***Usage note***: Preferred to **randomized controlled trial** for reasons indicated in the usage note for that term. Also see that comment for limitations on usage of the modifier *randomized*.

random number *n* - A **number** generated or drawn via some defined **random** or **pseudorandom process**.

random number generator *n* - A system for generating **random** or **pseudorandom numbers**, eg, a **computer program** generating such numbers.

pseudorandom *adj* - Being or involving entities, such as **numbers**, that are generated, selected, or ordered by a deterministic process that can be shown to generate sequences or orders that satisfy traditional statistical tests for **randomness**. rt: **quasirandom**, **random** ***Usage note***: Most computational schemes for generation, though usually referred to **random number generators**, are in fact pseudorandom. Generally, they are built using deterministic computational procedures that rely on a user supplied seed to start the generation process; use of the same seed on different occasions will generate the exact same sequence of numbers.

pseudorandom number *n* - A **number** that has been generated using a deterministic process, such as those underlying most computer packages for generation, that can be shown to generate sequences of numbers that meet traditional statistical tests for **randomness** [Knuth, 1969].[6] rt: **quasirandom number**, **random number**

quasirandom *adj* - 1. Appearing to be or resembling something **random**; random like. 2. Of, relating to, or concerned with a process considered to approximate a formal **randomization process**. 3. Being or involving entities, such as **numbers**, that are selected or ordered by some **rule** or procedure (eg, one based on the order in which people arrive at a **clinic**) that generates **sequences** that can be viewed as being like those produced or expected with a **random process** but where the rule or procedure is not amenable to testing, or if tested can be shown to yield results that do not satisfy traditional statistical tests for **randomness**. rt: **pseudorandom**, **random** ***Usage note***: Not to be confused with **pseudorandom**. See notes for **random** *adj, scientific* and **pseudorandom**.

quasirandom number *n* - A **number** that has been generated by a **rule** or procedure (eg, one based on Social Security **number**) that generates **sequences** of numbers that can be viewed as being like those produced or expected with a **random process**, but where the rule or procedure is not amenable to testing, or if tested can be shown to yield results that do not satisfy traditional statistical tests for **randomness**. rt: **pseudorandom number**, **random number** ***Usage note***: See note for **quasirandom**.

Dictionary entries with random or randomization as a base or modifier term

adaptive random treatment assignment *n*
adaptive randomization *n*
adaptive randomization design *n*
balanced randomization *n*
balanced randomization list *n*
baseline adaptive randomization *n*
Bernoulli random variable *n*
biased coin randomization *n*
blind randomization *n*
blocked randomization *n*
closed randomization *n*
cluster randomization *n*
complete randomization *n*
completely masked randomization *n*
completely randomized design *n*
completely randomized treatment design *n*
controlled randomization *n*
dependent random variable *n*

dynamic randomization *n*
fixed randomization design *n*
group randomization *n*
independent random variable *n*
lognormal random variable *n*
masked randomization *n*
nonrandom *adj*
nonrandom trial *n*
nonrandomized *v*
nonrandomized trial *n*
normal random variable *n*
number adaptive randomization *n*
open randomization *n*
outcome adaptive random treatment
outcome adaptive randomization *n*
partially masked randomization *n*
post-randomization *adj*
post-randomization examination *n*
post-randomization followup visit *n*
post-randomization visit *n*
prerandomization *adj*
prerandomization examination *n*
prerandomization visit *n*
pseudorandom *adj*
pseudorandom number *n*
pseudorandom process *n*
pseudorandomization *n*
quasirandom *adj*
quasirandom number *n*
quasirandom process *n*
quasirandomization *n*
random *adj, general*
random *adj, scientific*
random access *adj*
random access memory (RAM) *n*
random allocation *n*
random assignment *n*
random digit dialing *n*
random effect *n*
random error *n*
random number *n*
random number generator *n*
random order *n*
random permutation *n*
random process *n*
random sample *n*
random sampling *n*
random start *n*
random treatment assignment *n*

random variable *n*
random variation *n*
random walk *n*
random-effects model *n*
randomization *n*
randomization breakdown *n*
randomization design *n*
randomization examination *n*
randomization list *n*
randomization override *n*
randomization test *n*
randomization unit *n*
randomization visit *n*
randomize, **randomized**, **randomizing**, **randomizes** *v*
randomized *n*
randomized block *n*
randomized block design *n*
randomized clinical trial (RCT) *n*
randomized consent *n*
randomized control *n*
randomized control trial (RCT) *n*
randomized controlled clinical trial *n*
randomized controlled trial (RCT) *n*
randomized response technique *n*
randomized trial *n*
randomly selected control *n*
randomness *n*
randomness test *n*
restricted random assignment *n*
restricted randomization *n*
simple random sample *n*
simple randomization *n*
standardized random variable *n*
stratified random assignment *n*
stratified random sample *n*
stratified random sampling *v*
stratified random treatment assignment *n*
stratified randomization *n*
stratified-blocked randomization *n*
systematic random sample *n*
telephone randomization *n*
test for randomness *n*
uncontrolled randomization *n*
unit randomization *n*
unmasked randomization *n*
unrestricted random assignment *n*
unrestricted randomization *n*
urn model randomization *n*

References

1 **Meinert** CL: *Clinical Trials Dictionary: Terminology and Usage Recommendations*. The Johns Hopkins Center for Clinical Trials, Baltimore, **1996** (Meinert, 1996)

2 **Standards of Reporting Trials Group**: A proposal for structured reporting of randomized controlled trials. JAMA 272:1,926 - 1,931, **1994**. (Standards Group, 1994)

3 **Meinert** CL, Tonascia S: *Clinical Trials: Design, Conduct, and Analysis*. Oxford University Press, New York, **1986**. (Meinert and Tonascia, 1986)

4 **Begg** C, Cho M, Eastwood S, Horton R, Moher D, Olkin I, Pitkin R, Rennie D, Schultz KF, Simel D, Stroup DF: Improving the quality of reporting of randomized controlled trials: The CONSORT statement. JAMA 276:637 - 639, **1996**. (CONSORT Group, 1996)

5 **Rennie** D: How to report randomized controlled trials: The CONSORT statement. JAMA 276:649, **1996**. (Rennie, 1996)

6 **Knuth** DE: *Seminumerical Algorithms (vol 2; Art of Computer Programming)*. Addison-Wesley Publishing Co, Reading, Mass, **1969**. (Knuth, 1969)