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STATISTICAL QUESTION

Convenience sampling

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Researchers assessed the efficacy, acceptability, and safety of a topical alkane vapocoolant spray in reducing pain during intravenous cannulation in adults. A randomised double blind placebo controlled trial study design was used. The intervention was a blend of propane, butane, and pentane, which was sprayed less than 15 seconds before cannulation on to the relevant area of skin from a distance of 12 cm for two seconds. The control treatment was a water spray. The primary outcome measure was pain during cannulation, measured with a 100 mm visual analogue scale. Secondary outcome measures included discomfort during administration of the spray, success rate of cannulation, and side effects of treatment.¹

Participants were adults who required intravenous cannulation in the emergency department of a metropolitan teaching hospital. In total, 201 adult patients were recruited using convenience sampling. The intervention group consisted of 109 (54%) men, who had a mean (standard deviation) age of 58.2 (19.5) years. The researchers concluded that topical alkane vapocoolant spray was effective, acceptable, and safe in reducing pain during peripheral intravenous cannulation in adults in the emergency department.

Which of the following statements, if any, are true?

- a) Convenience sampling constitutes probability sampling
- b) Convenience sampling promotes external validity
- c) Convenience sampling threatens internal validity in a clinical trial

Answers

Statements *a*, *b*, and *c* are all false.

The purpose of the above trial was to assess the efficacy, acceptability, and safety of a topical alkane vapocoolant spray in reducing pain during intravenous cannulation in adults. A randomised double blind placebo controlled trial study design was used. The control treatment was a water spray. Participants were recruited to the trial using convenience sampling—they were selected because they were the easiest to recruit for the study. Sample members were adult patients who were consecutively admitted to the emergency department of a metropolitan teaching hospital and who needed intravenous

cannulation. Presumably, the researchers were currently working in the emergency department that the study was carried out in. Patients were recruited only if they met a series of inclusion criteria as described in the article.

Two types of sampling method can be used to recruit participants to a study—random sampling (sometimes called probability sampling) and non-random sampling (sometimes called non-probability sampling). Convenience sampling constitutes non-random (non-probability) sampling (*a* is false).

Random sampling involves some form of random selection of the population members. Each population member has a known and typically equal probability of being selected. Simple random sampling (sometimes referred to simply as random sampling) is the most straightforward type of random sampling. A sampling frame is constructed—that is, a list of all people belonging to the population. Constructing a sampling frame requires knowledge of exactly who is in the population. A sample of a fixed size is selected at random from this list, with all members of the population having the same probability of being selected, independently of all others. The probability that a population member will be chosen is known in advance. In contrast, convenience sampling in the above trial involved selecting patients because it was convenient and they were easily accessible. Sample members were not selected at random from the population of all adult patients meeting the inclusion criteria and admitted to emergency departments who required intravenous cannulation. Therefore, not all population members had an equal probability of being selected.

External validity and internal validity are essential components in the design, analysis, and inference of clinical trials. External validity is the extent to which the study results can be generalised to the population. This will largely depend on the characteristics of the sample members and the extent to which they represent the population. Internal validity is the extent to which observed treatment effects can be ascribed to differences in treatment and not confounding, thereby allowing the inference of causality to be ascribed to a treatment.

The members of the sample in the above trial were not selected at random from the population—they were selected for the trial because they happened to be easily accessible to the researchers.

Hence, the sample may not be representative of the adult population admitted to emergency departments who require intravenous cannulation. Therefore, convenience sampling does not promote external validity (*b* is false). The characteristics of any sample obtained using convenience sampling must be inspected to determine how well the sample represents the population. This can be difficult if the characteristics of the population are not known. Therefore, when assessing the usefulness of the results and conclusions of the above trial, it may be possible to assess only the extent to which they can be applied to adult patients in a different emergency department.

There is no reason why convenience sampling would have threatened the internal validity of the above trial (*c* is false). Internal validity was promoted by the random allocation of the sample members to the intervention or control group. Randomisation of participants meant that any systematic differences between the two treatment groups at baseline were minimised. Hence, any difference between treatment groups in the primary outcome would have been due to differences in

treatment and not to confounding—that is, differences in baseline characteristics. Therefore, providing the composition of the treatment groups did not change unduly after randomisation—for example, patients withdrawing consent—then the inference of causality could be ascribed to the active intervention of topical alkane vapocoolant spray.

Despite the potential limitations of convenience sampling, it is often used to recruit participants to a study because it is easy to do. Convenience sampling may be used in conjunction with most study designs and not solely with clinical trials.

Competing interests: None declared.

- 1 Hijazi R, Taylor D, Richardson J. Effect of topical alkane vapocoolant spray on pain with intravenous cannulation in patients in emergency departments: randomised double blind placebo controlled trial. *BMJ* 2009;338:b215.

Cite this as: *BMJ* 2013;347:f6304

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