American Journal of Epidemiology
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Vol. 158, No. 9
Printed in U.S.A.
DOI: 10.1093/aje/kwg232

PRACTICE OF EPIDEMIOLOGY

Evaluation of Cluster Randomized Controlled Trials in Sub-Saharan Africa

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Received for publication April 3, 2002; accepted for publication May 8, 2003.

- 51 CRTs evaluated
- Only 20% took clustering into account in sample size planning.
- Only 37% adjusted for clustering in analysis

TABLE 3. Results and analysis of eligible cluster randomized controlled trials

Study characteristic	Frequency	
	No.	%
Participants' flow diagram provided	7	14
Level of analysis stated		
Cluster	22	43
Individual	25	49
Both	3	6
Not stated	1	2
Clustering taken into account in calculating confidence intervals or *p* values	19	37
Results in absolute numbers provided in sufficient detail	32	63
Prognostic variables by treatment group reported	25	49
Any attempt to adjust for these variables described	16	31
Protocol deviations reported	6	12

Effect of Km on Number of Clusters and Cluster Size

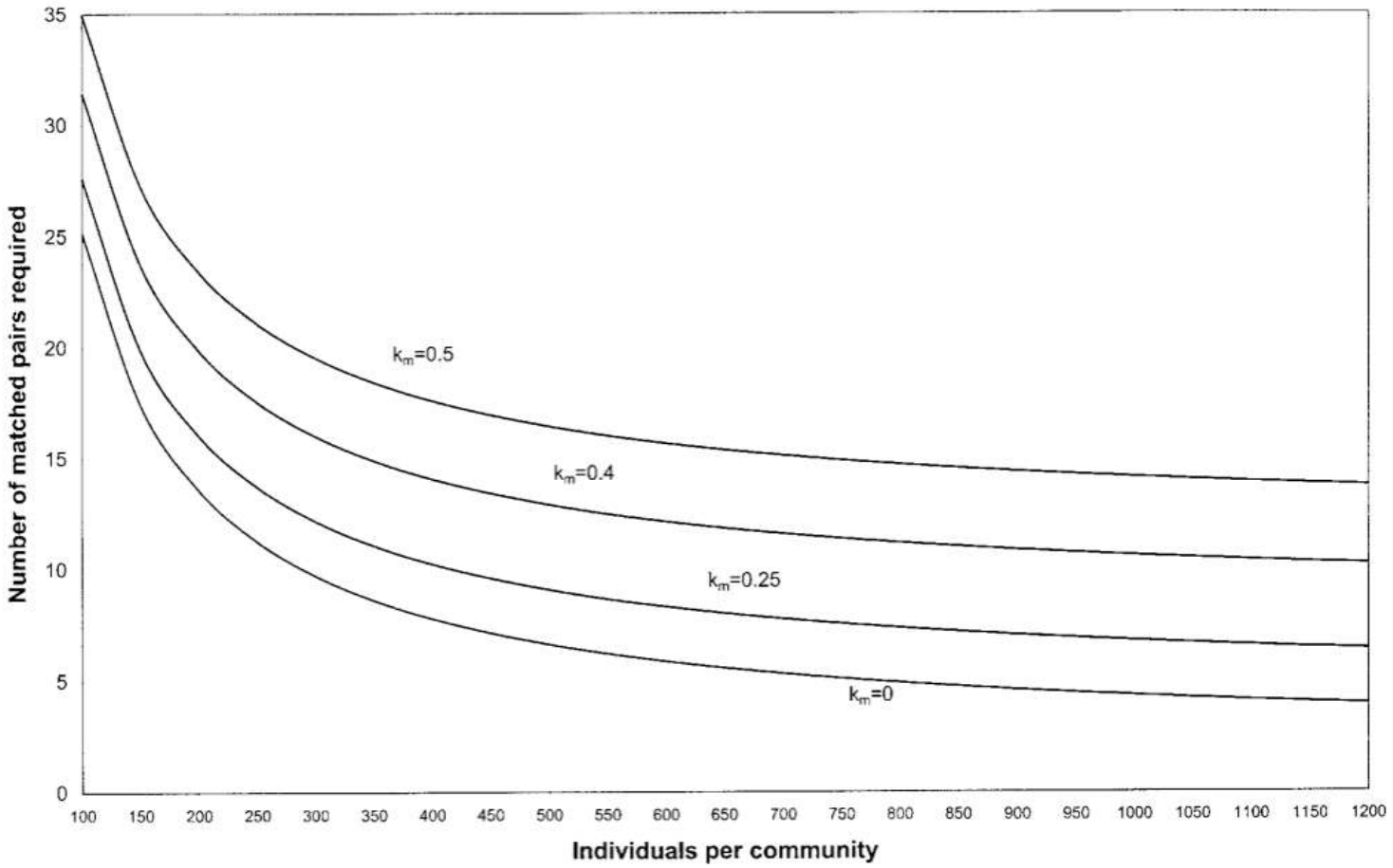

Figure 1 Sample size requirements for Mwanza trial. Graph shows number of matched pairs of communities and number of individuals per community required to detect reduction in cumulative HIV incidence from 2% to 1% for various values of k_m, the between-community coefficient of variation in incidence within matched pairs

Sample-Size Calculation

- Formulas from the textbooks
  - Hayes or Klar
- Software Packages: - Optimal Design, SSC, aCluster
- Stata: - SampClus ado add-in
- R: programming your own
- Simulations

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Simple sample size calculation for cluster-randomized trials

RJ Hayes and S Bennett

Background	Cluster-randomized trials, in which health interventions are allocated randomly to intact clusters or communities rather than to individual subjects, are increasingly being used to evaluate disease control strategies both in industrialized and in developing countries. Sample size computations for such trials need to take into account between-cluster variation, but field epidemiologists find it difficult to obtain simple guidance on such procedures.
Methods	In this paper, we provide simple formulae for sample size determination for both unmatched and pair-matched trials. Outcomes considered include rates per person-year, proportions and means. For simplicity, formulae are expressed in terms of the coefficient of variation (SD/mean) of cluster rates, proportions or means. Guidance is also given on the estimation of this value, with or without the use of prior data on between-cluster variation.
Case studies	The methods are illustrated using two case studies: an unmatched trial of the impact of impregnated bednets on child mortality in Kenya, and a pair-matched trial of improved sexually-transmitted disease (STD) treatment services for HIV prevention in Tanzania.

Keywords	Sample size, randomized controlled trials, cluster randomization, community randomization, between-cluster variation
Accepted	17 July 1998

Cluster Sizes for Unmatched CRTs

- **Rates:**

$$c = 1 + (z_{\alpha/2} + z_{\beta})^2[(\lambda_0 + \lambda_1)/y + k^2(\lambda_0{}^2 + \lambda_1{}^2)]/(\lambda_0 - \lambda_1)^2 \quad (2)$$

- **Proportions:**

$$c = 1 + (z_{\alpha/2} + z_{\beta})^2[\pi_0(1 - \pi_0)/n + \pi_1(1 - \pi_1)/n + k^2(\pi_0{}^2 + \pi_1{}^2)]/(\pi_0 - \pi_1)^2 \quad (4)$$

- **Means:**

$$c = 1 + (z_{\alpha/2} + z_{\beta})^2[(\sigma_0{}^2 + \sigma_1{}^2)/n + k^2(\mu_0{}^2 + \mu_1{}^2)]/(\mu_0 - \mu_1)^2 \quad (6)$$

Campbell – Sample Size

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Computers in Biology and Medicine 34 (2004) 113–125

Computers in Biology and Medicine

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Sample size calculator for cluster randomized trials

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Received 30 August 2002; received in revised form 24 March 2003; accepted 24 March 2003

Welcome...

Health Care Assessment
Delivery of Care
Health Care Organisation, Management and Policy
Health Professionals' Behaviour
Health Care Users
Quality Assurance
Research Tools

Methodological Research

BACK

The cluster randomised controlled trial is considered the optimal design when evaluating strategies to change professional behaviour. However, adopting such a design has implications for the design, conduct and analysis of a trial. A fundamental assumption of patient randomised controlled trials is that the outcome for an individual patient is completely unrelated to that for any other patient - they are said to be 'independent'. This assumption is violated in cluster randomised trials because patients within any one cluster are more likely to respond in a similar manner. A measure of this similarity is known as the intra-correlation coefficient (ICC). Because of this lack of independence, sample sizes require to be inflated.

We have developed two tools to aid the design of cluster trials in the implementation research field - a database of ICCs and a sample size calculator.

Database of ICCs

A downloadable excel spreadsheet contains a list of ICCs calculated from a number of different interventions and settings. Also downloadable, is a list of references for the data contained in the spreadsheet.

- Spreadsheet
- References

Sample size calculator

A sample size calculator for cluster randomised trials is obtainable from the link below. This is a self-extracting program.

- http://www.abdn.ac.uk/hsru/sampsize/ssc.exe

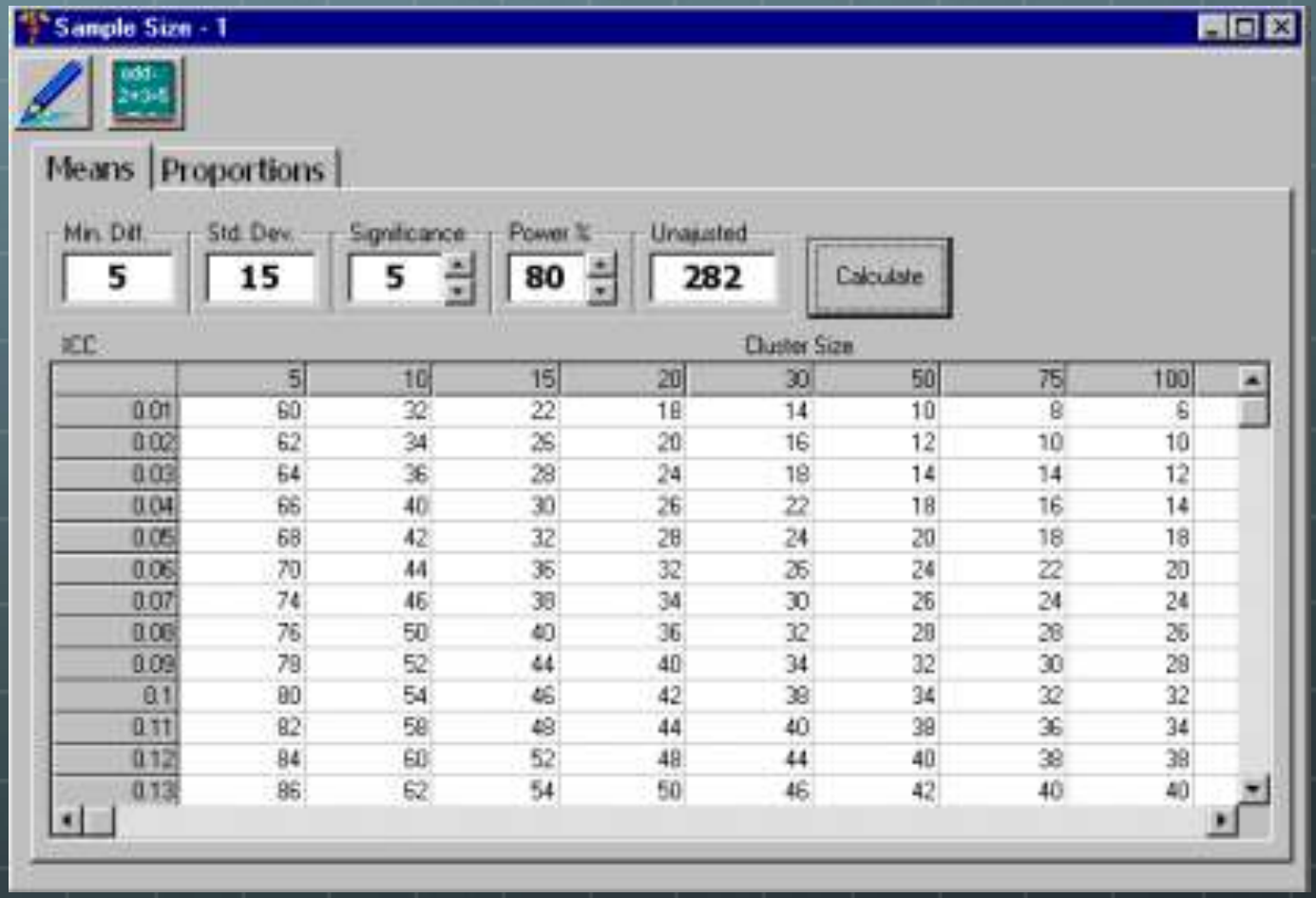
The instruction manual for this program can be downloaded as a pdf file at the link below.

- https://www.abdn.ac.uk/hsru/documents/calculationmanual.pdf

A further description of the calculator can be found in Campbell MK, Thomson S, Ramsay CR, MacLennan GS, Grimshaw JM. **Sample size calculator for cluster randomised trials.** Comput Biol Med2004;34:113-125.

If you have any queries about either of these resources, please contact Graeme MacLennan (g.maclennan@abdn.ac.uk)

Campbell – Sample Size



	5	10	15	20	30	50	75	100
0.01	60	32	22	18	14	10	8	6
0.02	62	34	26	20	16	12	10	10
0.03	64	36	28	24	18	14	14	12
0.04	66	40	30	26	22	18	16	14
0.05	68	42	32	28	24	20	18	18
0.06	70	44	36	32	26	24	22	20
0.07	74	46	38	34	30	26	24	24
0.08	76	50	40	36	32	28	28	26
0.09	78	52	44	40	34	32	30	28
0.1	80	54	46	42	38	34	32	32
0.11	82	58	48	44	40	38	36	34
0.12	84	60	52	48	44	40	38	38
0.13	86	62	54	50	46	42	40	40