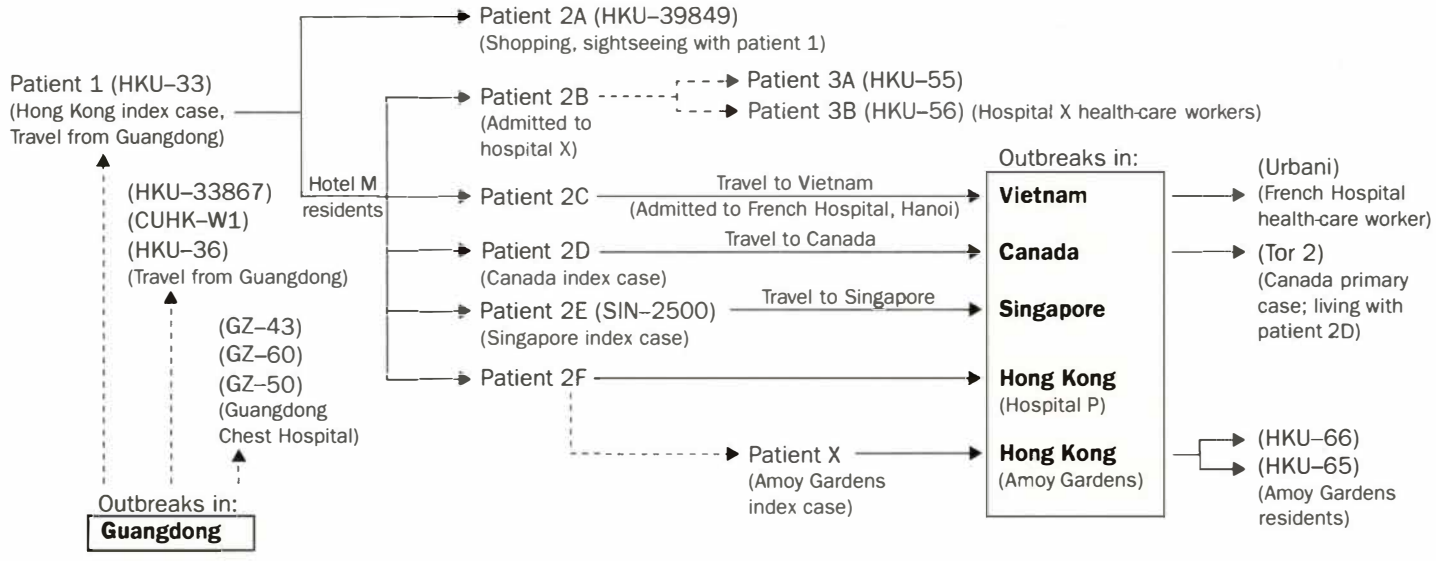


THIS molecular-epidemiological diagram tracks the rapid spread of virus isolates of severe acute respiratory syndrome (SARS) that caused disease outbreaks in many countries. Beginning with the unfortunate Patient number 1, some 20 arrows track key SARS patients, from Guangdong in China to Hong Kong to Vietnam, Singapore, and Canada (and then eventually to 30 other countries). The key index cases above (with their virus designations in parentheses) apparently "caused a disproportionate number of secondary cases, the so-called super-spreading incidents."

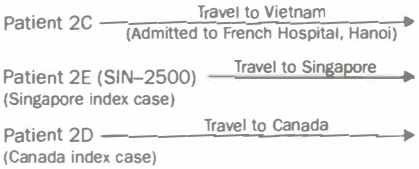
Y. Guan, J. S. M. Peiris, B. Zheng, L. L. M. Poon, K. H. Chan, F. Y. Zeng, C. W. M. Chan, M. N. Chan, J. D. Chen, K. Y. C. Chow, C. C. Hon, K. H. Hui, J. Li, V. Y. Y. Li, Y. Wang, S. W. Leung, K. Y. Yuen, and F. C. Leung, "Molecular epidemiology of the novel coronavirus that causes severe acute respiratory syndrome," *The Lancet*, 363 (10 January 2004), 99–104; diagram at 100, quotation at 103.

This practical, workaday diagram demonstrates excellent analytical practices for displays that use links and arrows to tie nouns together: timelines, trees, networks, organization charts, project management charts, and the like. These practices are:

Focus on causality The SARS graphic attempts to describe the *causal mechanisms* of disease transmission, as is nearly always the case in epidemiology. For SARS, the causal issues are fairly straightforward, compared with the complexities of our earlier examples tracing out creative influences in art or linking up 55 million years of ancestral evolution. Uncertainties in causal links can sometimes be shown graphically; the SARS diagram indicates uncertain transmission routes with dotted arrows.

Multiple sources and levels of data The SARS graphic presents evidence from molecular isolates, clinical observations, epidemiological detective work, and worldwide public health statistics—*whatever evidence it takes to understand what is going on.* Too often diagrams instead rely solely on one type of data or stay at one level of analysis.

Annotated linking lines Links and arrows should provide specifics: when and how the link operates, its strength and persistence, credibility of evidence for the link. Identical links should be used only if identical processes operate everywhere. The SARS graphic distinguishes between more and less certain links, and also annotates several links.

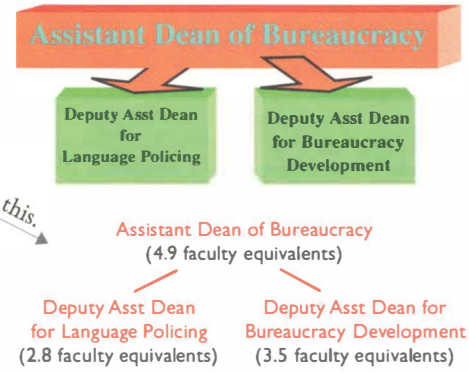


Annotated nouns Like linking lines and causal arrows, nouns in diagrams should be labeled, annotated, explained, described. The SARS analysis shows patient names with virus strain identification, description, travels. Annotated nouns combine with annotated arrows to help narrate the epidemic. The graphic begins by describing *Patient 1* in Hong Kong, not *Patient 0* in Guangdong, since the Chinese government suppressed information about the epidemic in China.

Efficiency of design Like a good map, the SARS graphic is straightforward, direct, with no unnecessary elements. In contrast, clunky boxes, cartoony arrows, amateur typography, and colorful chartjunk degrade diagrams. If your display looks like a knock-off from a corporate annual report or a PowerPoint pitch, start over. *Designs* for analytical diagrams should be clear, efficient, undecorated, maplike; the *content* should be intense, explanatory, evidential, maplike. The metaphor is the map, not stupidity.

Thus, for example, the omnipresent boxes of organization charts are rarely needed. If every name is highlighted, no name is. Maps don't put boxes around city names. The location of the typography *alone* indicates the 2-dimensional location of each bureaucrat; the space gained by the absence of all those little boxes can then provide additional information, such as the salary equivalents of the now-unboxed bureaucrats. Omitting boxes increases explanatory resolution.

Disaster at the Federal Emergency Management Agency, www.fema.gov.



Credibility An analytical graphic should provide reasons to believe. The SARS chart presents a coherent story, diverse data, knowledgeable detail. Published in *The Lancet*, a leading international, peer-reviewed medical journal, the article reports explanatory detective work rather than marketing products for commercial clients or covering up for governments. Most of the 18 authors work at public health organizations. All this helps add up to a credible diagram, at least until better evidence or alternative explanations come along.

Alternative diagrams test the credibility of the favored diagram. What are the competing diagrams and alternative assumptions? Are the links credible, documented, explained, quantified? Does the published diagram ignore relevant variables? Consumers of presentations should take causal diagrams and linking lines seriously, just like real evidence.