



# Triangulation in research, with examples

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## What is triangulation

Triangulation is a method used to increase the credibility and validity of research findings.<sup>1</sup> Credibility refers to trustworthiness and how believable a study is; validity is concerned with the extent to which a study accurately reflects or evaluates the concept or ideas being investigated.<sup>2</sup> Triangulation, by combining theories, methods or observers in a research study, can help ensure that fundamental biases arising from the use of a single method or a single observer are overcome. Triangulation is also an effort to help explore and explain complex human behaviour using a variety of methods to offer a more balanced explanation to readers.<sup>2</sup> It is a procedure that enables validation of data and can be used in both quantitative and qualitative studies.

Triangulation can enrich research as it offers a variety of datasets to explain differing aspects of a phenomenon of interest. It also helps refute where one dataset invalidates a supposition generated by another. It can assist the confirming of a hypothesis where one set of findings confirms another set. Finally, triangulation can help explain the results of a study.<sup>3</sup> Central to triangulation is the notion that methods leading to the same results give more confidence in the research findings.<sup>4</sup>

Four types of triangulation are proposed by Denzin (p.301):<sup>5</sup> (1) data triangulation, which includes matters such as periods of time, space and people; (2) investigator triangulation, which includes the use of several researchers in a study; (3) theory triangulation, which encourages several theoretical schemes to enable interpretation of a phenomenon and (4) methodological triangulation, which promotes the use of several data collection methods such as interviews and observations.

## Examples of studies using triangulation

Below, we offer two examples of triangulation within research studies, providing a context for each study and a description of how triangulation was used and successfully implemented to ensure an in-depth and more unbiased set of findings.

### Example 1

Johnson *et al.*<sup>6</sup> qualitative study aimed to identify system influences on decision making in a pre-hospital setting with paramedics. Several data sets were included and comprised exploratory interviews with ambulance service staff (n=16); document review observations of paramedic shifts (n=34); paramedic accounts (n=10) via audio-recorded 'digital diaries'; staff focus groups (n=3) and service user focus groups (n=3) to explore a range of experiences and perceptions. The approach followed Denzin's<sup>5</sup> multiple triangulation approach, which encourages several methods to collect data and multiple investigators with varied expertise.

Phase I of the study focused on understanding the context of the study and included interviews with ambulance service staff and the collection of demographics and local policies. The second phase involved observation of paramedics' daily work in order to throw light on decisions related to transporting patients. Focus groups with paramedics, followed by focus groups with service users were then completed in order to share personal experiences of the decisions made by the ambulance service in practice. The final phase included workshops to feed back findings.

Data were coded and thematically analysed. The observations of paramedic shifts identified the complexities of the decision-making process related to the context. The observations were supplemented by the interviews and focus groups. Each research method exposed one aspect of reality.<sup>5</sup> This multimethod, multi-disciplinary collaborative research was insightful. It permitted cross-validation, and facilitated exploration, of issues that influenced the decision making of paramedics and concerns and experiences of service users.

### Example 2

A study was undertaken to explore the quality of care for patients in a unique model of primary healthcare in Ontario, Canada: the Nurse Practitioner-Led Clinic (NPLC)<sup>7</sup>. The focus was on the care of patients with diabetes and at least one additional chronic condition, with the assumption that this group of patients represents those with the most complex clinical presentations managed in family practice settings. A multiple case study design was chosen for this research because with this approach, analysis of a variety of data arising from several NPLCs allowed for assumptions to be made about the model as a whole.<sup>7</sup> Additionally, both qualitative and quantitative research methods were used in the study. Mixing methods is a form of triangulation in research seen as mitigating the weaknesses found in single methods.<sup>8</sup>

The first research method was a chart audit, conducted on randomly selected charts of adult patients in five NPLCs who had diabetes and at least one additional chronic condition. The variables included demographic items as well as clinical data related to the care of patients with diabetes. The data were analysed to determine the completeness of the care of diabetes for the subjects.<sup>9</sup>

The second research method was interviews with nurse practitioners (NPs) working at the five NPLCs to determine their perceptions of the quality of care delivered in the NPLC model for patients with diabetes and other chronic conditions. Data from the interviews were analysed using the processes related to an integrative description design.<sup>10</sup> The draft themes arising from the analysis were forwarded to the participants for their feedback and were confirmed through a review of literature. Finally, a detailed document search was under-

taken, including but not limited to academic articles, media releases and articles, letters to editor, government policy statements and publications released from the NPLCs. These data were used to confirm and support the findings of the chart review and NP interviews, representing triangulation.

With analysis completed separately for the qualitative and quantitative parts of the study, the final step was analysis of the NPLCs individually and then as a group. An extensive analysis process arising from Stake's multiple case methodology was implemented.<sup>11</sup> This process included coding and identification of themes for individual NPLCs, then across the NPLC model as a whole. The final product represented triangulation in that each final theme represented analysis of data from at least two data sources, and literature was used to further support these conclusions.

### Limitations of triangulation

Triangulation offers richness and clarity to research studies<sup>8</sup> but also has limitations. It adds to the complexity of the research making it more time-consuming.<sup>6</sup> When used as a method for combining research methodologies, triangulation may not be achieved in a uniform or consistent manner. Additionally, researchers may not adequately explain their techniques for blending results.<sup>12</sup> In addition, there may be times when comparison of the findings of two sources is inconsistent or conflicting. Triangulation does not always adequately mitigate problems in a chosen research methodology. The processes of triangulation are complex and require a skilled analyst. Finally, the value of triangulation may be overestimated in some studies.<sup>13</sup>

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