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Introduction

Statistical Process Control (SPC), as a methodology, is useful in understanding variation and is applied to a wide variety of industries and systems. While there are many examples in the peer reviewed literature of the application of SPC in understanding specific healthcare related measures, there are fewer published reports of studies that have compared SPC to other, more frequently used analytical methodologies.

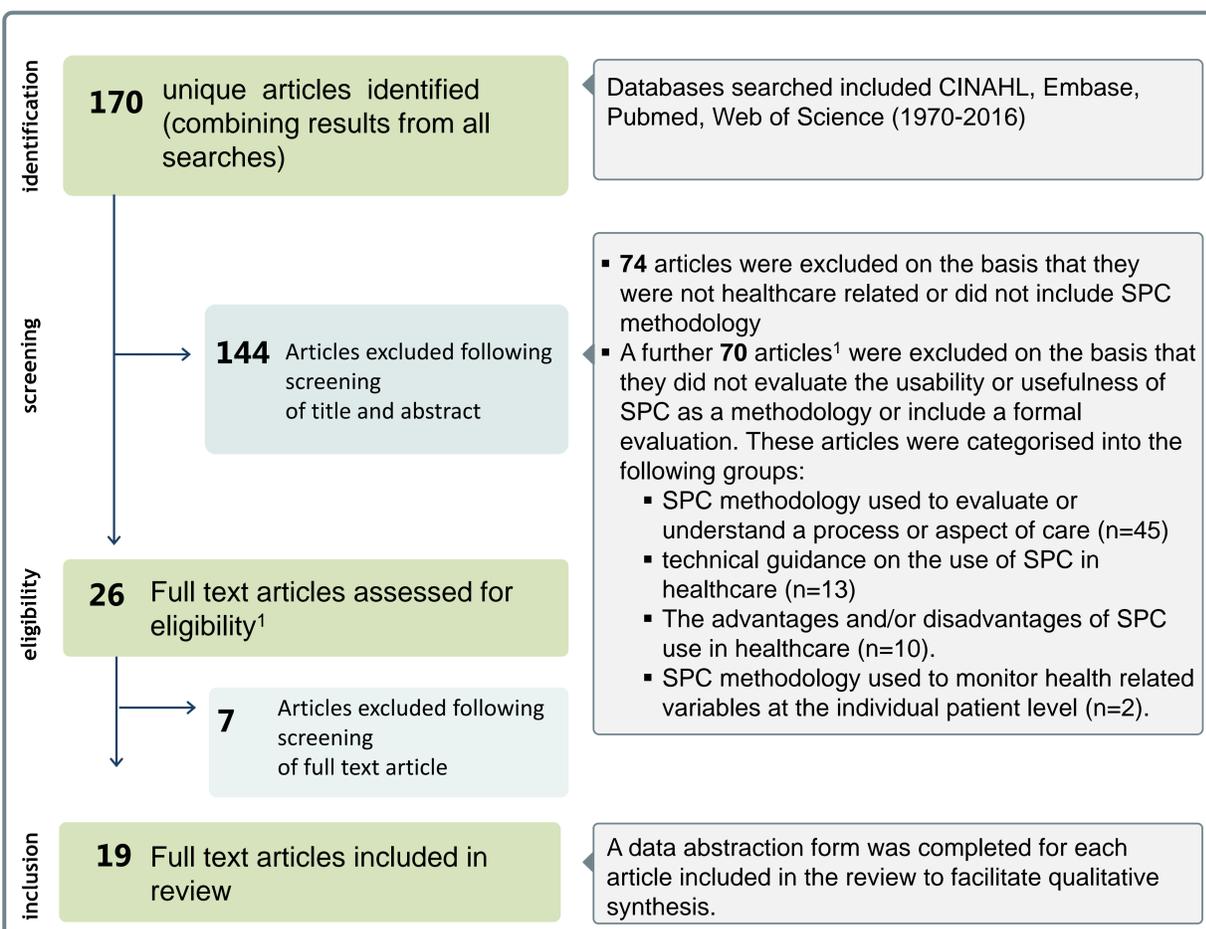
Background

This review was conducted to support a partnership project between the Social Care Division and the Quality Improvement Division to develop a Quality Profile in order to drive and evaluate quality improvement and inform strategy and decision making. The review provides the evidence base for the use of SPC charts by senior managers to identify opportunities for improvement as well as to identify successful quality improvement initiatives.

Key Findings

- The number of eligible articles included in the study (n=19) was relatively low in comparison with the total number of articles that relate to the use of SPC methodology in healthcare (n=96). Although the use of SPC in healthcare continues to grow (Thor et al, 2007), there remains a deficit in the literature of articles that demonstrate how SPC can be more effective than other methods of display of healthcare data.
- The most common study design among the 19 articles included in the review were case studies. Only one randomised control trial was identified whereas five review articles were included in the final 19 articles reviewed. This is a reflection of the difficulty in designing studies that specifically address the research question.
- The articles contained a number of case studies where SPC was compared to another method of displaying data. Details of a sample of case studies from six individual papers are summarised in Table 1. In all cases, the authors concluded that SPC methodology was not only appropriate in healthcare, but it provided a more useful understanding of healthcare data than alternative methods such as league tables, red-amber-green based charts or bar charts.
- The review of Koetsier (2012) is valuable in highlighting differences in how SPC methodology is applied in the literature. These include differences in the rule set used to interpret SPC charts. In order to ensure consistency of application of SPC methodology in QI work, the Quality Improvement Division have adopted the rule set as described in the Health Care Data Guide (Provost and Murray, 2011).

Fig. 1: Summary of Results:

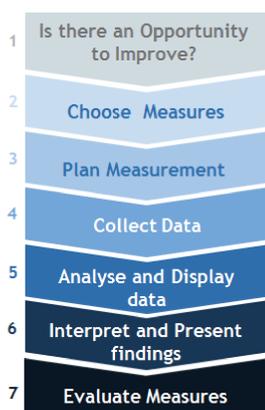


¹These articles are included in the 96 articles specified in 'Key Finding 1' that relate to the use of SPC methodology in healthcare

Table 1: 6 Examples of SPC Compared to Other Methods of Data Presentation

Reference	Measure	Comparison of SPC charts with other methods of data presentation	Conclusion
Anhoj et al (2016)	Count of number of adverse events in Mental Health services	Bar chart with target compared to an SPC Chart	The bar chart highlights three instances where the target is breached. However, the same data displayed on an SPC chart shows only normal variation.
Guthrie et al (2005)	% of Type II diabetes patients with HBA1c ≤7.4% in GP practices	League table with and without 95% Confidence Intervals compared to a Funnel Plot	The Funnel Plot shows that most of the variation is random and there are less signals for action than are observed using the league tables.
Marshall et al (2004)	30-Day mortality following admission for myocardial infarction at each of 28 acute care hospitals (case study 3)	Ranked histograms with 95% confidence intervals compared to an SPC chart	5.9% of acute care hospitals were 'singled out' for further investigation based on league tables compared to 0.7% using SPC charts (P=0.002). Using the SPC chart, only one service provider showed unexpected variation on the SPC chart (showing a rate lower than the lower control limit).
Mohammed et al (2001)	Mortality rate in 9 neonatal units (Case study 4)	League tables compared with an SPC chart	Parry et al (1998) concluded that league tables were unreliable as indicators of performance. Using the same data to generate an SPC chart, Mohammed et al demonstrated that only normal variation was observed.
Schmidke et al (2016a)	Number of unplanned admissions within 48 hours of discharge	Line graph (as provided in board papers) compared to an SPC chart	Only common cause variation was observed using the SPC chart to display these data. The line graph did not provide an understanding of whether the variation observed was expected or not.
Walley et al (2016)	% of Emergency Department patients that are seen within 4 hours	Paired comparison before and after an intervention using a two column bar chart compared to an SPC chart	Using a bar chart to display a paired comparison before and after the introduction of an MAU, an increase in the % of ED patients seen within 4 hours was evident. An SPC chart based on the same data shows that this is an incorrect interpretation as the improvement was not sustained. Within three weeks, the % of ED patients seen within 4 hours had returned to levels consistent with those prior to the intervention.

Measurement for Improvement Curriculum



This review has also helped to inform the Measurement for Improvement (MFI) Curriculum developed by the Quality Improvement Division. The curriculum describes the Context and 7 Steps to Effective Measurement for Improvement² and details the tasks, knowledge and skills those engaging in MFI work need to perform. Step five specifically relates to SPC methodology.

²Adapted from the 'Guide to Measurement for Improvement', available at nhselect.nhs.uk

Fig. 2: The 7 Steps to Effective Measurement for Improvement

References

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Acknowledgements

- Gráinne Cosgrove, Deirdre Carey (QID)
Aoife Lawton, Gethin White (Dr. Steevens Library, HSE)
Social Care Division (SCD) Quality Profile Project Group
Gerry Clerkin, Head of Quality & Safety (SCD)

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