



H e a l t h M a r k e t I n q u i r y

Promoting Healthy Competition

**METHODOLOGY PAPER:
APPROACH TO ASSESSING MARKET POWER OF HEALTH
FACILITIES**

26 August 2016

INTRODUCTION

1. In the Statement of Issues published on 1 August 2014, the Market Inquiry into the Private Healthcare Sector (the Inquiry) set out a number of potential sources of harm to competition in the South African healthcare market. These “theories of harm” include market power, barriers to entry into and expansion in a market, imperfect information and the regulatory framework. The Inquiry seeks to test whether, and (if so) to what extent, these potential sources of harm exist in order to reach conclusions as to what (if anything) can and should be done about them.
2. *Market power* is defined in section 1(1) of the Competition Act 89 of 1998 as amended (the Act), which governs the Inquiry, as the power of a firm “to control prices, to exclude competition or to behave to an appreciable extent independently of its competitors, customers or suppliers”. For a concern to arise a firm must have both the *means* to exercise market power and the *incentive* to do so.
3. The Act links the concept of “market power” to that of dominance. It requires a higher standard of behaviour from firms deemed to be dominant than is required of firms in general. They are not allowed to abuse their dominance, whether over customers or rivals, in various ways specified in the Act. There may be a number of dominant firms in the same market. Section 7 of the Act (a) conclusively presumes a firm to be dominant if it has 45% or more of the market in question; (b) raises a presumption of dominance if a firm has at least 35% but less than 45% of the market, unless it can show that it does not have “market power”; and (c) provides for any firm to be held to be dominant if in fact it has “market power”.
4. In order to determine a firm’s *share* of a market, two elements must first be specified:
 - 4.1. the relevant product market; and
 - 4.2. the relevant geographical market within which the products are traded and the firms compete.
5. The relevant product market comprises all of those products and/or services which are regarded as interchangeable or substitutable by the consumer, by reason of the products’ or services’ characteristics, and their prices and their intended use.¹ The relevant geographic market is the area within which rival firms currently supply, or could supply, the relevant product(s) to the same consumers.²
6. Defining a relevant market (or markets) is an analytical tool that — if it can be effectively applied — assists in reaching conclusions regarding the existence (or otherwise) of market power, and thus of the prevailing state of competition. It is important to note, however, that a precise market definition is not necessary for the assessment of market power where other evidence provides a sufficient basis for reliable conclusions.
7. In its 2008 report to the Competition Commissioner, the Panel that conducted the inquiry into certain aspects of competition in retail banking (the Banking Enquiry) said:
 - 7.1. *“Where market shares must be established in order to reach a conclusion of dominance, accurate definition of the boundaries of the relevant market in product and geographical terms is obviously necessary. If market definition were lacking, then substitute products and/or suppliers could be wrongly excluded, or wrongly included, when it came to calculating a particular firm’s market share. However, where other factors including the behaviour of a firm itself provide the evidence that it possesses market power, then market definition loses its analytical importance. It is then enough to be able to*

¹ See *Massmart Holdings / Jumbo Cash and Carry (Pty) Ltd* [2001-2002] CPLR 193 (CT) (Case No. 47/LM/Aug01), para 8.

² See e.g. *Tongaat Hulett Group / Transvaal Suiker Bpk* [1999-2000] CPLR 127 (CT) (Case No. 83/LM/Jul00), para 43.

describe the product and area in respect of which the power is held. As the Competition Tribunal (“the Tribunal”) expressed it in Natal Wholesale Chemists (Pty) Ltd v Astra Pharmaceutical Distributors (Pty) Ltd [2001-2002] CPLR 363 (CT) (Case No. 98/IR/Dec00), pp 376-377: ‘We concur with the complainant that the purpose of defining a relevant market is to identify the exercise of market power [as] defined in the Act ... and that market definition is only a tool for estimating market power, not a scientific test. ... If the exercise of market power, as defined, is identified — if, for example, the firm is able to raise appreciably the price of its product without occasioning a significant reduction in demand — then a market relevant for the purposes of the enquiry will have been identified.’³

8. In the *Horizontal Merger Guidelines* issued by the Department of Justice and the Federal Trade Commission in the United States on 19 August 2010, it is acknowledged that —
 - 8.1. *“The Agencies’ analysis need not start with market definition. Some of the analytical tools used by the Agencies to assess competitive effects do not rely on market definition, although evaluation of competitive alternatives available to customers is always necessary at some point in the analysis.*
 - 8.2. *“Evidence of competitive effects can inform market definition, just as market definition can be informative regarding competitive effects. For example, evidence that a reduction in the number of significant rivals offering a group of products causes prices for those products to rise significantly can itself establish that those products form a relevant market. ...”*
9. Market definition may thus not be required when market power or anticompetitive effect can be demonstrated directly, for example by inference from firms’ behaviour, either alone or taken together with structural characteristics including the number, distribution, size and other features of firms.
10. It is well-accepted internationally that healthcare markets are characterised by a complex, heterogeneous set of goods and services and a number of interdependent markets, which interact in various ways.⁴ The provision of healthcare services is dependent on the interaction of these various markets; between the consumers and healthcare service providers; the payers and the healthcare service providers; and the payers and the consumers. These dynamics impact on demand and supply factors in ways that would not ordinarily occur in other markets.
11. Basically, competition between hospitals and between hospital groups takes place at two levels. They compete nationally for inclusion on particular terms as suppliers to medical schemes and their provider networks. At the same time they compete at a local level to attract both physicians and patients who will receive care on the terms specified in their contracts with the funders.
12. This document outlines the methodologies that the Inquiry will employ in analysing market power of healthcare facilities at the local level. The Inquiry’s initial objective in this regard is to develop an overview of local concentration of facilities which may give rise to concerns regarding the effectiveness of hospital competition. While there may be effects of market power at the national level given national contracting and negotiation dynamics, different competitive dynamics in each local market would suggest that specific effects of market power may need to be identified in each of those markets.

³ *Banking Enquiry Report* (2008), Chapter 2, p 37 n19. Bishop and Walker agree that the definition of the relevant market is merely a tool for aiding the competitive assessment. Bishop, S. and Walker, M. 2010. *Economics of E.C. Competition Law: Concepts, Application and Measurement*. Sweet and Maxwell, London, p104.

⁴ See Arrow, K.J. “Uncertainty and the welfare economics of medical care”, *The American economic review*. Vol 53 Number 5, December 1963, pp 942-973. Hurley, J. “An Overview of the Normative Economics of the Healthcare Sector” in Culyer, A.J. Newhouse, J. P. eds., *Handbook of Health Economics*. Elsevier, Amsterdam., Vol 1A, Chapter 2, p 67.

13. It should be noted at the outset that defining markets has a broader purpose in this Inquiry than it would have in individual enforcement or merger cases. The main objective of the analysis is to generate a representative and unbiased overview of local market concentration of the South African private hospital sector. The intention initially is to apply a number of techniques or methods that individually and in combination will allow for a fair and unbiased overview of market concentration, and an assessment of the potential of market power at the local level.
14. The rest of this document is divided into three sections: Overview of market definition; Healthcare facility catchment areas; and Concentration measures. The first of these deals with the theoretical approach to market definition and discusses its relevance to healthcare facilities.
15. The second section outlines the starting point in the process of defining relevant regional geographical markets and assessing concentration at this level, that is the identification of a “catchment area” of a facility. Patient flow data is assembled spatially, taking advantage of GIS mapping. This refers to the distribution of regional/local supply and demand activities in relation to healthcare facilities to identify the catchment areas from which facilities draw their patients.
16. This section then goes on to explain how the mapping of patient flow data is applied to delineate the catchment areas from which each facility draws the bulk of its patients. In practice, competition authorities internationally delineate catchment areas by employing methods such as the exclusion of the most remote 10 or 20% of patients, either in terms of driving distance or in terms of travelling time, of a facility’s patients from the area.
17. A fixed percentage cut off criterion while superficially arbitrary nevertheless accommodates the most commercially relevant patient flows. We will adopt a 20% cut off, but we will start with a methodology for excluding the most remote patient addresses from the service area, using an algorithmic approach. This then will conclude the identification of the catchment areas relevant to different facilities.
18. The final section proceeds to deal with measures of market concentration. The Inquiry will consider three measures of market concentration.
 - 18.1. The first measure is a fascia count. A facility’s fascia count is calculated simply by summing the number of competitors that lie within each hospital’s catchment area. These will be corrected for hospitals belonging to the same economic entity (hospital groups).
 - 18.2. As a second measure, conventional Herfindahl-Hirschmann indices (HHIs) and market shares will be calculated, based on our approximation of relevant geographical markets.
 - 18.3. The third measure is the Logit Competition Index (LOCI).
19. A relevant geographical market includes the catchment area of the reference hospital and the realistic competitive alternatives available to its patients. The Inquiry will establish the spatial overlap of the catchment areas of surrounding hospitals with the catchment area of the reference hospital, and subsequently analyse the propensity of patients to change hospital in the overlapping areas to any competing facilities in reaction to a hypothetical change in conditions relevant to their preferences.⁵
20. This provides an initial basis for estimating the degree to which each facility exerts (or could exert) a competitive constraint on the other. If it is thus found that a number of surrounding facilities present a competitive constraint on the reference hospital, these hospitals should be included in what will now be

⁵ Under normal circumstances preferences would be exercised around prices and service quality. Travel time and ease of access may also play a role.

called the 'relevant geographical market' that the reference hospital is competing in. This then serves as the basis for calculating measures of concentration such as HHIs and market shares. It must however be noted that establishing geographic markets cannot be determined mechanistically and a degree of informed judgement is required.

21. As noted, there may be other factors which affect the propensity of patients within a particular catchment area to switch to alternative facilities, and which thus also have to be considered. Examples might be where funders' designated service provider arrangements apply to one facility but not the other; where one has a specialised service profile which the other lacks; or where the demographic makeup of the two facilities' respective patients are substantially different. Moreover, the influence of the referring practitioner may obviously be an important component in the patient's choice of facility.
22. Catchment area-based techniques for calculating market concentration assume that hospital services (the product market) can be regarded as homogeneous. Consideration of the specific factors that may in practice affect patients' choice of facilities within particular overlapping catchment areas will go some way towards addressing the problems inherent in this assumption.⁶ At the same time a complementary technique for assessing market concentration — the Logit Competition Index (LOCI) — will be applied. LOCI is based on a model of heterogeneous product markets.⁷ The LOCI analysis will also be informed by the spatial characteristics of the patient flow data.
23. These approaches, individually and in combination, should provide the Inquiry with an overview of local concentration of healthcare facilities and of indicators of pockets of market power in local markets across South Africa, and may help it to explore the relationship between concentration and outcomes.⁸

OVERVIEW OF MARKET DEFINITION

24. The generally accepted conceptual tool used to define a relevant market is the *hypothetical monopoly test* or SSNIP test - which stands for "*small but significant non-transitory increase in price*." The test considers a product, or a group of products, and the geographic area where a hypothetical monopolist would be able to increase its profits by imposing at least a small but significant and non-transitory increase in price.
25. Thus, for example, in establishing whether product A should be regarded as being in a market of its own, or whether it shares a wider market with product B, the question is typically asked: in the event that a hypothetical monopolist supplying product A were to raise the price of the product by 5% – 10%, would customers switch to product B in such numbers as to make the price increase unprofitable? If so, product B must be included in the relevant market together with product A. If not, then product B must be excluded. By a similar line of reasoning, the geographical boundaries of a relevant market are established, so that all

⁶ In *Netcare Hospital Group (Pty) Ltd / Community Hospital Group (Pty) Ltd* 68/LM/Aug06 (CT) para 33, the Tribunal noted that "hospitals provide differentiated services, because they typically provide a bundle of services varying in range and kind. This means that the closer the similarity in services the greater the likelihood that they compete with one another or put differently, they may vary in the degree to which they may be considered competitors. A consequence of this, conventional HHI analysis may throw up a skewed picture of a market as the extent of concentration it reveals may bear no relationship to the reality of competition."

⁷ The United Kingdom's Competition and Markets Authority in its healthcare market investigation employed the LOCI measure to get a better view of private sector hospital concentration and market power. The Netherlands Authority for Consumers and Markets also has been applying LOCI in most of their recent merger analysis.

⁸ The Inquiry is aware that concentration, while an indicator of possible market power, does not in and of itself prove that market power exists. It must be considered in its full practical context.

the relevant suppliers — and only these — of the product or group of products are included.⁹ The assessment considers competitive constraints from both the demand-side (consumers) and supply-side (providers) of a market.

26. This test, and similar price-based tests, can for a variety of reasons not be applied easily to healthcare markets – and more specifically not to South Africa. It is generally accepted that healthcare markets do not function like conventional markets. In particular:
- 26.1. Healthcare facilities “typically provide a bundle of services varying in range and kind”,¹⁰ thus complicating the delineation of any particular product market.
 - 26.2. The involvement of third-party payers (medical schemes and insurers) means that consumers do not directly pay for the services they consume, and this renders them price-insensitive. Demand itself can be distorted by the fact that people are insured.
 - 26.3. In South Africa funders and hospital groups negotiate contracts primarily at a national level – removing to a large extent the possibility of regional price differentials acting as competitive constraints.
 - 26.4. There is a gap between the information available to consumers of healthcare services and the information available to the providers. Most patients will not have the knowledge or experience to assess which facility or practitioner to choose, or what service to purchase, or at what price. Thus consumers in most cases cannot and do not make decisions independently, but rely on the advice and decision-making of others whose own interests and incentives may dominate.
 - 26.5. Regulatory factors, as well as other restraints, also impact on behaviour on both the supply and demand sides of healthcare markets, affecting any assessment of potential substitutability. (Examples in the South African context are: the uncertain implications of the licencing regime; unspecified levels of out-of-pocket payments; the limiting effects of designated service provider networks; the effects of insurance plans and gap cover, especially on consumer behaviour; the effects of price setting at a national level on the responsiveness of supplier and consumer behaviour in local markets.)
27. These factors, separately and together, make the SSNIP test very difficult to apply in a reliable way. This impacts on the way healthcare markets can and should be defined. As a result, competition authorities worldwide and adjudicating courts have found it difficult to develop and apply a consistent method of

⁹ For the acceptance of the SSNIP test in South Africa, see *Patensie Sitrus Beherend Bpk v Competition Commission and others* [2003] 2 CPLR 247 (CAC) (Case No. 16/CAC/Apr02) at 256*i*-257*i*. In situations where the firm or firms concerned do possess market power and have *already* maximised profits by raising their prices to the maximum that customers will bear, the SSNIP test may give a misleading result.

¹⁰ Netcare Hospital Group (Pty) Ltd / Community Hospital Group (Pty) Ltd 68/LM/Aug06 (CT) (reasons issued 5 November 2007), para 33.

delineating relevant healthcare markets.¹¹ The South African competition authorities are no exception to this,¹² and the Tribunal has not so far established an appropriate method applicable to South Africa.¹³

28. Although it may be challenging to define relevant healthcare markets in principle, this does not detract from the need to undertake rigorous analysis of competitive constraints which operate in relevant parts of the healthcare sector. Scientific precision of market definition may not be possible, but each market under consideration should nevertheless be described in a way that corresponds to *commercial reality*. That is, it must identify where consumers access services and depict the way suppliers — in this case healthcare facilities — actually or could compete.

Product market definition in healthcare facilities

29. Historically, defining the relevant product market in healthcare facilities has not been a key issue of dispute in cases before the Tribunal and in other jurisdictions.¹⁴

30. Ordinarily, demand-side substitution is impossible as most of the individual products offered by facilities are not reasonably interchangeable for the consumer - a patient needing a cataract removed cannot turn as a substitute to a procedure of another kind. And connected with that procedure comes a bundle of other services necessarily related to it. Supply-side substitution, on the other hand, may occur in the sense that facilities may be able, for example, in response to changes in competitive conditions, to add procedures that they did not previously offer, or change the way in which procedures are conducted or supplied. In practice, however, it is generally recognised that there is probably little supply-side substitutability or elasticity of supply in healthcare facilities markets.¹⁵

31. The practical approach to product market definition has generally been to *cluster* products and services, leading to a typical product market definition of “*general acute care hospital services*”.¹⁶ This is because acute care hospitals are conveniently taken to provide similar portfolios of products and services. For a combination of reasons, most international jurisdictions explicitly distinguish between inpatient and outpatient hospital care, so that they are not combined in the same relevant market.

32. The Tribunal, in cases pertaining to private hospitals, has also tended to aggregate the individual treatments and services into the broad grouping of the provision of “*private hospital care*”. This product

¹¹ See e.g. Varkevisser, M. Capps, C.S. and Schut, F.T. “Defining hospital markets for antitrust enforcement: new approaches and their applicability to The Netherlands”. *Health Economics, Policy and Law*, Vol 3, Issue 1, January 2008, pp 7-29. McCarthy, T.R. and Thomas, S. 2003. *Geographic Market Issues in Hospital Mergers*. <http://www.nera.com/content/dam/nera/publications/archive1/3698.pdf>

¹² See Netcare Hospital Group (Pty) Ltd / Community Hospital Group (Pty) Ltd 68/LM/Aug06 (CT) (reasons issued 5 November 2007), paras 31-37 and 48; also Phodiclinics (Pty) Ltd and others / Protector Group Medical Services (Pty) Ltd (in liquidation) and others / Supreme Health Administrators (Pty) Ltd and others 122/LM/Dec05 (CT) (reasons issued 21 February 2006), paras 21-40.

¹³ Cf *Life Healthcare Group (Pty) Ltd / Joint Medical Holdings Ltd* 74/LM/Sep11 (CT) (reasons issued 24 October 2012), para 16, in which the parties agreed on a definition of the relevant market for purposes of the case.

¹⁴ See Varkevisser, M. Capps, C.S. and Schut, F.T. “Defining hospital markets for antitrust enforcement: new approaches and their applicability to The Netherlands”. *Supra*, pp 8-9.

¹⁵ See e.g. ABA Section of Antitrust Law, *Antitrust Health Care Handbook* (4th ed. 2010), p 133 n13.

¹⁶ Gaynor M., Kleiner S.A., Vogt W.B. “A structural approach to market definition with an application to the hospital industry”. NBER Working Paper Series, January 2011, p 8. *ABA Section of Antitrust Law, Antitrust Health Care Handbook* (4th ed. 2010), p 131.

market definition has consistently been used since the first Afrox merger in 2001.¹⁷ Public sector services have hitherto been excluded from this definition.¹⁸

33. Recently, the United Kingdom's Competition and Markets Authority (CMA) has adopted a disaggregated approach to product markets in reviewing hospital mergers, wherein it treats each medical specialty as a separate market, with separate inpatient and outpatient services within each facility.¹⁹ Some product clustering was then recognised, where the products concerned were found to face similar competitive restraints. Also the CMA's Private Healthcare Market Investigation applied tests on separate product markets by medical specialty.²⁰
34. Disaggregation was anticipated by Zwanziger *et al* (1994) who recommended a disaggregated approach to hospital product markets.²¹ Sacher and Sylvia (1998) further found that such a disaggregated approach may yield valuable insights for detailed competition analysis.²² Recently, Hentschker *et al* (2014) found that a very general product market definition such as "acute in-patient care" averages out severe discrepancies that become visible when concentration is considered on the level of individual diagnoses.²³
35. For purposes of this Inquiry, we do not find it necessary at the outset to depart from the aggregated approach adopted by the Tribunal to defining product markets for health facilities. This aggregated approach may include primary, secondary, and tertiary services.

Geographic market definition in healthcare facilities

36. A key area of contestation and complexity has been in the area of geographic market definition for healthcare facilities.
37. It is important to note that the demand for healthcare facilities is largely influenced by the patient's domicile relative to the location of the facilities, and to some extent by the location and admitting privileges of practitioners who refer patients to facilities.
38. Designated network arrangements between medical schemes, facilities and practitioners are further influenced by and thus negotiated around the location of the patient.

¹⁷ Afrox Healthcare Limited / Amalgamated Hospital Limited [2001-2002] CPLR 106 (CT) (Case No. 53/LM/Sep01).

¹⁸ Afrox Healthcare Limited / Amalgamated Hospital Limited *supra* para 9.

¹⁹ CMA decision: Anticipated merger between The Royal Bournemouth and Christchurch Hospitals NHS Foundation Trust and Poole Hospital NHS Foundation Trust. Office of Fair Trading ME/5351/12. And CMA's "A report on the anticipated merger of Ashford and St.Peter's Hospitals NHS Foundation Trust and Royal Surrey County Hospital NHS Foundation Trust" of 16 September 2015. See also CMA guidance on the review of NHS mergers, CMA29, 31 July, 2014, para 6.38.

²⁰ CMA Private Healthcare Market Investigation. Final Report, *Queen's Printer and Controller of HMSO 2014*, p 4.

²¹ Zwanziger, J., Melnick, G. and Eyre, K.M. "Hospitals and antitrust: defining markets, setting standards, *Journal of Health Politics*", *Policy and Law*, Vol 19(2), 1994: 423-447.

²² Sacher, S. and Silvia, L. "Antitrust issues in defining the product market for hospital services", *International Journal of the Economics of Business*, Vol 5(2) 1998: 181-202.

²³ Hentschker, C., Mennicken, R. and Schmid, A. 2014, "Defining hospital markets – an application to the German hospital sector", *Health Economics Review*, 2014 Vol 4:28.

39. This renders the *patient* and *facility location* a critical metric to define the market and begin the investigation of competition among healthcare facilities.²⁴ Travel time and road distance are taken to be possible proxies for “the price” patients pay (burden they bear) when they decide *not* to visit the nearest facility and therefore choose to travel further than strictly necessary. The Inquiry will consider both travel time and distance, and decide on which criterion is to be preferred once the data to analyse are available.

HEALTHCARE FACILITY CATCHMENT AREAS

40. Establishing the catchment areas of facilities is the first step in the identification process of relevant markets. The Inquiry will use GIS mapping as an input to this. GIS mapping is a computer-based process which allows the user to collect, store, retrieve and analyse spatial data on digital maps. Spatial data can be represented by means of points, lines, polygons, grids and Enumerator Areas (EAs).²⁵

41. By means of GIS, the Inquiry seeks to map out geocoded patient flow data to identify patient origin in respect of facilities of interest. Patient flow data is the evidence most consistently relied upon – also internationally and irrespective of the test employed - to identify the basic catchment area of a facility²⁶.

42. The main data layers required for the GIS mapping are:

42.1. *Master facility data* for all facilities, facility types, number of registered beds, and service offerings.

42.2. *Medical claims data* which includes admission and discharge dates, patient addresses (de-identified — see below) and diagnostic codes.

42.3. *Geographical spatial data* which includes socio-demographic data, road networks and Statistics SA spatial data layers.

43. To ensure the anonymity of patient data, the Inquiry established a de-identification mechanism which hides personal information such as name, surname, identity number and physical address in such a manner that individuals can't be identified, but so that the data still has its analytical relevance.

44. The analysis of patient flow data generally involves two steps.

44.1. First, patient origin data in respect of each facility of interest is used to identify that facility's current catchment area.

44.2. Second, the patient flow data is examined to estimate which patients who currently use that facility could or would turn to an alternative facility following an attempt to exercise market power through, for example, a significant price rise.²⁷ It may further provide information on designated provider networks of doctors and facilities, on medical scheme coverage and identify practitioner overlaps between facilities of interest.

²⁴ Antwi, A.O., Gaynor, M. and Vogt, W. “A Competition Index for Differentiated Products Oligopoly with an Application to Hospital Markets”. Carnegie Mellon University, 2006. Hammer, P. and Sage, W. “Critical Issues in Hospital Antitrust Law”, 22 *Health Affairs* (Nov./Dec. 2003), p 90. *ABA Healthcare Mergers and Acquisitions Handbook*, 2003, p 36.

²⁵ Bivand R.S., Pebesma R.S., E., & Gómez-Rubio, V., 2001 *Applied Spatial Data Analysis with R: 10 (Use R!)*. Springer New York, 2001.

²⁶ McCarthy, T.R. and Thomas, S. 2003. Geographic Market Issues in Hospital Mergers.

<http://www.nera.com/content/dam/nera/publications/archive1/3698.pdf>

45. In international competition practice a catchment area consists of the smallest set of postal codes (*zip codes* in the United States) from which the facility under consideration draws its patients (after excluding outliers). However, the use of postal codes for this purpose in South Africa has serious shortcomings. A postal code here typically results in areas that are too large.
46. The Inquiry proposes to make use of standard geospatial levels as defined by Statistics SA — the EAs — which avoids the shortcomings of postal codes. The EA thus replaces the postal code applied in similar international and national studies.
47. The Inquiry will thus use geocoded patient flow data to determine the catchment area of a facility of interest (the reference facility). In order to delineate the relevant area from which facilities draw their patients, and to exclude possible outliers, the Inquiry will make use of a Lavielle algorithm.²⁸
48. This technique has the advantage that it takes informed decisions on which patients are considered outliers for each individual facility analysed. It is therefore less arbitrary when compared to traditional approaches. This methodology however has, to the best of our knowledge, never been applied in competition analysis of this kind before. The Inquiry will therefore also test more traditional cutting-off criteria, such as the area from which the hospital under consideration draws 80% of its patients, based on road distance or on travel time.

CONCENTRATION MEASURES

Conventional concentration and market share measures

49. As explained in the section on Healthcare facility catchment areas above, the GIS mapping, complemented by the Lavielle algorithm approach, will inform the Inquiry on the catchment areas of South African hospitals. Alternatively the more conventional 80% cut-off approach to catchment areas, based on patient distance and travel time will also be tested for consistency with this method.

Fascia Counts

50. A first indicator of market concentration will be derived from doing a *Fascia count*.
51. A fascia count is a simple and widely used measure of local concentration,²⁹ whereby a facility's fascia count is computed by summing the number of competitors that lie within each facility's catchment area. Fascias will be corrected for group-ownership (e.g. two hospitals of the same hospital group will count as one). An advantage of the fascia method is that it is simple to calculate and intuitively simply to interpret.
52. Caveats of the fascia count are that it treats all competitors as equal, irrespective of size or range of specialties. For instance it does not count a hospital situated just outside the catchment area of the reference hospital, despite the fact that may nevertheless share an important catchment area overlap with the reference hospital and possibly impose an important competitive constraint on it.
53. The Inquiry will consider a fascia count of one or less (that is, the reference hospital faces one or no competitors located within its catchment area) as an indication of market concentration concern.

²⁸ The Lavielle algorithm provides a method for estimating the number of change points and their location. Lavielle, M. 'Using penalized contracts for the change-point problem', *Elsevier*, 2005 vol. 85, 1501-1510. A technical explanation of the proposed methodology employing the Lavielle algorithm to calculate catchment areas for each hospital in South Africa is provided in the Appendix.

²⁹ The United Kingdom's Private Healthcare Market Investigation used Fascia counts as one of two *quantitative filters* to inform the Investigation of which hospitals are located in more concentrated areas and required further investigation. CMA, 2014, 'Annotated issues statement – Appendix B', Annex 1.

Market shares

54. The next step in the process towards identifying local concentration will be to analyse the spatial overlaps of the catchment areas of hospitals. Catchment areas, as defined, reflect current market behaviour. They present an overview of where patients go for their treatment under the existing circumstances. Catchment areas therefore do not in themselves provide an answer to the question where patients could practicably turn for acute inpatient services if faced with a 'significant and non-transitory' price increase (or quality reduction).
55. Consequently hospital catchment areas may not encompass the full range of practical alternatives open to consumers, and the analysis may therefore need to be broadened to encompass all facilities that present credible competitive alternatives. Those hospitals that do present credible alternatives, in conjunction with the reference hospital(s), constitute the competitors in the relevant geographic market.
56. The critical question now is: what are the facilities that constitute credible competitive alternatives to a particular reference facility?
57. This is one of the most widely contested subjects in competition law enforcement – especially in merger control or abuse of dominance cases. Clearly *responsiveness* to price increases or quality reductions by consumers of hospital care is an important element in answering this question. The lower the responsiveness, the larger must be the proportion of the reference facility's patients located in the area of overlap and thus *at risk* of changing hospital,³⁰ in order for a credible competitive constraint to exist.
58. Real world responsiveness of South African consumers to changes in the price or quality of hospital facilities' services is influenced by a multitude of factors. Internationally, the direct responsiveness of consumers of hospital services to price and quality of service changes is generally accepted to be low. This is all the more the case in South Africa. Most hospital costs are covered by medical schemes and therefore patients generally don't pay the bill themselves.
59. For this reason they are substantially insensitive to price changes or price differentials. Furthermore publicly available and robust information on safety and quality of services provided in hospitals – both clinical quality and patient reported outcomes – appears to be scarce in South Africa creating a further structural impediment to responsiveness. Patients may largely rely on the advice (if any) of their referring doctor in this respect.
60. Schemes, administrators and Managed Care Organisation (MCOs) theoretically should be able to selectively contract facilities or otherwise 'steer' the patient to competitive alternatives, in reaction to a facility's raising prices or reducing quality. The information so far provided to the Inquiry in the submissions of stakeholders does not provide substantial evidence of an active role or capacity of funders in this regard. However, the Inquiry's examination of the competitive dynamics of this sector may provide further information in this regard.

'Critical loss' analysis

61. Another important question in analysing the effect of a hypothetical *small, but significant non-transitory increase in price* (SSNIP) or an equivalent decrease in quality and the reaction to this of consumers of a facility's services, is: how many patients would have to switch hospitals in order to make the hospital's price

³⁰ Assuming heterogeneous patients with respect to scheme coverage and price-sensitivity.

increase unprofitable? This is also known as *critical loss analysis*³¹ in competition enforcement. Factors that may influence the answer to this question, amongst others, are: the price-cost margin of products associated with these switching clients; the ratio of fixed and variable costs of running a hospital; and the existing levels of overcapacity of hospitals.

62. Critical loss analysis is potentially a robust and direct way to arrive at relevant geographical markets. It is a way of applying the hypothetical monopoly test, which was introduced by the US competition authorities in 1982 and which is used to this day by competition enforcement agencies worldwide. It has been used over the years in important cases in several industries, including the healthcare industry, in several countries.³²
63. In the South African context, however, neither medical scheme members nor medical schemes influence prices at a sub-regional level. For this reason the Inquiry sees no value in the application of this approach and it has therefore been discarded. Similar reasoning applies to the application of diversion ratios³³, which will also not be used by the Inquiry.

Overview of concentration

64. The analyses of relevant geographical markets for the purposes of this Inquiry must be put in context. As indicated above, the main objective of the analysis is to generate a representative and unbiased overview of local market concentration of the South African private hospital sector.
65. The Inquiry intends to test different reasonable approaches to catchment areas and geospatial overlap, and to critical numbers of ‘patients at risk’ of switching to an alternative facility in these overlapping areas. It intends to apply reasonable assumptions on the responsiveness of patients, including the influence of referring doctors and funders (schemes, administrators, MCOs, insurers and networks).
66. Once the relevant market for every hospital in South Africa has been identified, the traditional indicators for market concentration will be calculated. We will consider the HHI³⁴ and market shares as indicators of market concentration and possible market power. The Inquiry will apply the latest guidance of the United States competition authorities as to the interpretation of the HHI levels, as calculated.³⁵
67. In doing so, the Inquiry will have due regard to the observation by the Competition Tribunal that HHIs “*are indicative statistical measures; they are not determinative.*”³⁶ They must be supported by additional

³¹ Harris, R. & Simons J.J., 1989. Focusing Market Definition: How Much Substitution is Necessary? *Research in Law and Economics*, 12, pp.207-226.

³² Cf. Gaynor, M., Samuel A. Kleiner, and William B. Vogt, ‘A structural approach to market definition with an application to the hospital industry’, NBER Working paper 16656, January 2011.

³³ Diversion ratios also rely on the extent to which network agreements resulting from selective contracts divert patient demand based on competitively determined prices.

³⁴ The HHI is usually constructed by dividing the number of beds for each facility by the total number of beds within the market to obtain each hospital’s share. Alternatively this could be constructed using number of patients. The market share of each facility is then squared and the squared shares of all facilities in the relevant market are summed to create an index, which is in the range of between zero and 10.000. The higher the index number, the more concentrated the market.

³⁵ Cf in this regard Sutherland and Kemp, *Competition Law of South Africa*, pp 10–36 to 10–39 and the authorities there cited. The 2010 merger guidelines issued by the Federal Trade Commission and the US Department of Justice provide reference points for the interpretation of HHI levels and changes to these levels which are likely to be indicative of anti-competitive mergers. These levels are: markets with HHI’s below 1500 are deemed to be unconcentrated, between 1500 and 2500 are regarded as moderately concentrated and levels above 2500 are indicative of competitive concerns.

³⁶ JD Group Ltd/Ellering Holdings Ltd , supra, at 73e.

evidence.³⁷ Examples would be possible countervailing power of schemes and administrators, as well as the potential for rivals to enter and contest the market.

Logit Competition Index (LOCI)

68. The GIS data and distribution of patients over EAs will also be used as inputs in the calculation of LOCI values as a direct and complementary method to arrive at measures of local concentration and indicators of local market power. The application of LOCI similarly relies on using patient flow data as with the catchment area approach outlined above. The LOCI methodology is data-intensive and is calculated using data on the number of all patients who visited a facility – referred to below as the ‘focus’ facility – in a particular period of time. The LOCI depends on data on each patient’s address or a suburb, and, for purposes of applying the LOCI methodology, the Inquiry will allocate these to the EAs from which the focus facility draws patients. As explained below, the relevant EAs are then treated as “submarkets” of the focus facility.
69. LOCI provides an alternative technique for assessing concentration and market power without the need to define relevant geographic markets in the sense previously discussed. The LOCI measure originates from a working paper presented by Akoso Antwi, Gaynor and Vogt in 2006.³⁸ It has subsequently been used in competition enforcement in the United States, in The Netherlands and recently in the CMA’s Private Healthcare Market Investigation in Britain.³⁹ It measures concentration derived from a differentiated products oligopoly model, calculating a weighted average market share for a focus facility. It computes market shares in each identified submarket from which that facility draws patients. It weighs these market shares and calculates one average market share as an indicator for each focus facility’s market power in the entire area that covers its submarkets. The Index is defined as one minus the average market share, and therefore could more appropriately be referred to as a *competition index*. It varies between zero and one, where zero represents pure monopoly in the area identified.
70. A key attraction to the use of LOCI is its ability to assess market concentration without having to define relevant geographic markets. Traditional market concentration indices, like market shares or the HHI, are as accurate as the delineation of the relevant market is. Furthermore the LOCI methodology is theoretically grounded, relatively easy to calculate, and does not require potentially arbitrary assumptions about the size of the catchment areas around particular facilities, and whether these involve concentric rings drawn around facilities on a map, or so-called isochrones that account for the influence of features such as access roads to a facility. It simply includes all patients.
71. The LOCI methodology has been used as an *addition* to the traditional market concentration approaches which this Inquiry also proposes to apply. It introduces further dimensions to the analysis as it takes into account the relative importance of submarkets as a differentiating characteristic between private healthcare facilities. It also weighs the concentration indices for the percentage of patients the focus facility draws from the different submarkets. It also reflects the relative strength of the potential competitive constraints posed by different facilities within and outside a catchment area. The LOCI methodology can be modified to assess the impact of network ownership (calculation adjusted for facilities within the same group) on market concentration.

³⁷ Id.

³⁸ Akoso Antwi, Gaynor and Vogt (2006), Cf footnote 24.

³⁹ CMA. APPENDIX B: Measuring local concentration using a market-share-based measure. 2013.

72. The LOCI methodology views individual patients as the health facilities' consumers and assumes that consumers from different submarkets represent different competitive constraints to the facility, depending on the importance of the submarket to the hospital, that is, on the market share the focus facility holds in that particular submarket. Patients in submarkets where the focus facility has a large market share are attributed a greater weight in the calculation of the average than submarkets which are less important to the hospital. The concentration index so derived can either be defined as a weighted average of market shares, or as one minus the weighted average of market shares. In the latter case the resulting concentration index is the weighted average of each hospital's market *weakness* in each submarket/consumer type; i.e. the proportion of consumers not choosing to visit that hospital in the area the hospital draws its patients from.

73. A numerical example might clarify this.⁴⁰

Table 1: Illustration for calculating LOCI (not corrected for group ownership)

Submarket	Number of patients	Number of patients attending focus hospital	Market share of focus hospital	Proportion of all patients attending focus hospital
SM 1	2,100	700	30%	55%
SM 2	2,000	500	25%	39%
SM 3	2,400	48	2 %	4 %
SM 4	2,500	25	1 %	2 %
All	9,000	1,273	14%	100%

74. $LOCI = 1 - \{(0.30 \times 0.55) + (0.25 \times 0.39) + (0.02 \times 0.04) + (0.01 \times 0.02)\} = 0.74$. That is one minus the weighted average market share of 0.26. Underlying the calculation are four separate market shares. The weights attached to these individual market shares reflect the importance of each submarket to the focus hospital. So, SM 1 in our example is of the highest importance because 55% of all patients of the focus hospital are from that submarket. Now if we compare the 0.74, or rather the 0.26 weighted market share to the traditional sum of market shares, which has been calculated as 14% (1273:9000), we note that here the weighing is according to the relative size of each area. And this does not reveal the strong heterogeneity in concentration across the four submarkets. LOCI therefore provides valuable additional information to the traditional concentration measures.

75. Two issues arise when calculating LOCI. The first is on what basis to compute market shares. The Inquiry will initially calculate market shares on the basis of volumes of patients. The Inquiry may consider repeating the analysis using other variables such as beds and revenues. This may capture other strategic variables in the analysis. The Inquiry will consider facilities with a LOCI of <60, or a weighted average market share of >40% as *potentially* holding market power – if this is confirmed by the catchment area analysis above.⁴¹

⁴⁰ The example uses the number of patients to measure and weight market share. The analysis can be done by any variable reflecting a hospital's operations: revenue, patients or beds.

⁴¹ It should be noted that the weighted averages emerging from the LOCI methodology would not, in and of themselves, lead directly to a conclusion of 'dominance' (or otherwise) in terms of section 7 of the Act. It could, nevertheless, play a part in such an analysis.

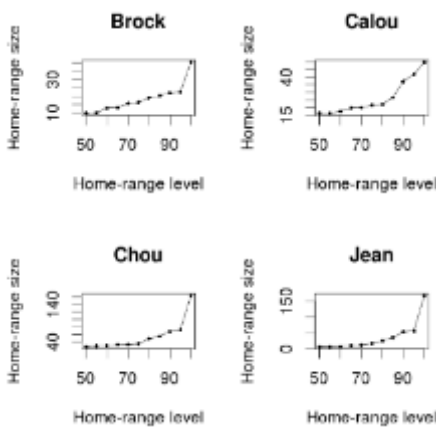
76. The second issue is the identification of submarkets as an initial input in the LOCI calculation. As indicated above, the Inquiry proposes to use the EAs as submarkets. That is, within the relevant product market consumers are identified by their location at the highest level of detail that Statistics SA identifies.
77. The choice of submarkets involves a trade-off between accurate measurement of shares in each submarket (which benefits from bigger submarkets) and a weighting scheme that reflects the level of heterogeneity between submarkets (which benefits from smaller submarkets that reflect heterogeneity better). LOCI implicitly assigns more weight to a facilities' share in areas that are nearby. With this the heterogeneity of patients' preferences with respect to distance is directly accounted for in the LOCI. The CMA's recent Private Healthcare Investigation and Dutch competition authorities (NZa) in the past have applied similar weighting to market shares in submarkets; that is weights proportionate to the importance (nearness) of these submarkets.
78. A critique on the weighting according to importance/nearness has been that the more relevant patients in terms of competitive constraints and thereby in limiting market power of the focus facility, are not the ones staying nearby the hospital, but are those who are located further away from the hospital. These patients are the ones who are "at risk" – that is, who would be likely to switch if prices or quality provided change.⁴²
79. The Inquiry is aware of specific characteristics and possible points of attention of both traditional and new concentration measures and will keep them in mind when interpreting the individual and combined results of the two concentration analyses presented. In order to increase the robustness of the analysis, the Inquiry will combine several approaches that each contribute to confirming the existence, or not, of market power.

⁴² Guerin-Calvert, M.E. (2014) "Market definition and relevant markets: assessment of competitive alternatives", submission to the South Africa Competition Commission's Health Market Inquiry and Davis P., Comments on UK CC's annotated issues statement: The CC's approach to measuring concentration, April 2013.

ANNEXURE 1: ESTIMATING CATCHMENT AREAS USING THE LAVIELLE ALGORITHM

The following method has been followed in the development of a catchment area, using the minimum convex polygon (MCP) in conjunction with the Lavielle algorithm. The Lavielle algorithm is part of the family of algorithms dealing with “change point analysis” which measures sudden changes in the performance of a process.

The MCP approach is a widely used estimation method which calculates the *smallest convex polygon* enclosing all the spatial points provided. The method was first developed and applied by Burton (1943) in measuring spatial movements of mammals. Besides the traditional applications in ecology, the technique has been applied in the measurement of various spatial movement applications.



It is a normal practice in the MCP to remove movements farthest away from the centroid of all movements. The choice of removing an arbitrary % of spatial points is normally performed by mapping the surface area (MCP area) against the number of spatial points plotted. Outliers are deemed those spatial points which create large surface areas which are not deemed a “normal” occurrence. The accompanying figure shows ranges for four individuals where an assumption of a 5% outlier seems logical, except for “Calou” which doesn’t show a large jump in area at the 95% range. This exercise is a visual exercise conducted by the modeller to determine what % can apply in studies.

In calculating the catchment area for 400 hospital facilities using approximately 40 million patient transactions, visual inspection is not a feasible option – nor can a standard % removal of outliers be recommended, as demonstrated above.

Thus, for a hospital facility, *outliers* should be determined by those spatial points which create a sudden large increase in surface areas. The Lavielle algorithm measures the sudden change in surface area and selects the optimal outlier % for each of the hospital facilities in the following manner:

- Calculate the MCP area (in km²) in increments of 5% around the hospital facility. This means that starting at the centroid, the MCP includes points in increments of 5%, and then the minimum convex hull area for each increment.
- The MCP increments and population sizes are fed into the Lavielle algorithm which calculates the “break points” in the surface areas for the spatial population.
- The algorithm then determines the optimal value for the largest surface break with the smallest population increment.
- This calculated value is used to create the spatial catchment area by excluding the “outliers”.

The extracted patient address data from the claims data provides the spatial points in the area of the facility. The catchment area is calculated by fitting the smallest possible area around these points, but in the process, outliers are removed in a uniform manner when a spatial point increases the surface area dramatically.

References:

- Lavielle, M. (2005). “Using penalized contracts for the change-point problem”, *Signal Processing* **85**: 1501-1510. Elsevier.
- Burt, W. H. (1943). "Territoriality and home range concepts as applied to mammals". *Journal of Mammalogy* **24** (3): 346–352. [JSTOR 1374834](https://www.jstor.org/stable/1374834).