Post-Action Evaluation of CCS's Merger Clearance in the Dialysis Market

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CONTENTS

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Synopsis

On 26 December 2012, the Competition Commission of Singapore cleared the proposed acquisition by Asia Renal Care (SEA) Pte. Ltd. of Orthe Pte. Ltd. This paper evaluates the development of the outpatient haemodialysis market for a period of 30 months after the merger to assess whether the merger has led to any adverse impact on competition in the market.

The purpose of evaluating past decisions is for CCS to understand the impact of its past interventions on the relevant markets and whether the outcomes can be improved. Where appropriate, CCS will set out learning points that can contribute to the robustness of future decisions.

The findings suggest that generally the prices of haemodialysis treatments did not increase more in areas affected by the merger, and the average price for outpatient haemodialysis treatment in Singapore did not increase more than the average price of dental and medical treatments. This may be due to competition from expansion of existing competitors and entry of new competitors into the market which have reduced the market share of the merged entity.

I.   BACKGROUND

1.   On 26 December 2012, CCS issued a decision to clear the proposed acquisition by Asia Renal Care (SEA) Pte. Ltd. ("ARC") of Orthe Pte. Ltd. ("Orthe") (collectively known as "the Parties") ("Decision"). The proposed acquisition was notified to CCS on 16 November 2012.

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[1]The authors of this study are CCS economists who were not involved in the assessment of the merger application. The authors thank past CCS interns who helped to collect the data and Dr. Aamir Hashmi who independently reviewed the study. Dr. Hashmi is an Assistant Professor of Economics with the National University of Singapore. His broad research interests include Industrial Organization and Firm Strategy. He is especially interested in how market structure affects innovative activity of firms. His research has been published in a number of international peer reviewed journals including the Review of Economics and Statistics, Macroeconomic Dynamics, Journal of International Money and Finance and the Singapore Economic Review. Dr. Hashmi graduated from University of Toronto with a PhD in Economics in 2007. More information about him is available on his personal website at http://aamirhashmi.com. A summary of the peer review is attached at **Annex C**.

2.   In the Decision, CCS has assessed the relevant market to be outpatient haemodialysis ("HD") treatment in dialysis centres operated by restructured hospitals and private sector service providers, including joint ventures between restructured hospitals and private operators in Singapore. Accordingly, the relevant market excludes services provided by Voluntary Welfare Organisations.[2]

3.   ARC and Orthe were assessed to have a high combined market share of [70-90%] and a high post-merger CR3[3] of [70-90%] in 2011.[4] Notwithstanding, the acquisition was cleared on the basis that there would be no substantial lessening of competition ("SLC") in view of the following key factors:

   a) Barriers to market entry and expansion were not high;
   b) Limited product differentiation across providers;
   c) Ability of patients to switch dialysis centres; and
   d) In the vicinities where ARC's and Orthe's dialysis centres were near each other, there was at least one competing dialysis centre located nearby.

4.   On 18 December 2012, CCS commenced the study to evaluate the effects of the cleared merger, to review the key factors considered in CCS's assessment, and to assess whether the merger had actually resulted in an SLC in the market.

II.   METHODOLOGY

5.   This evaluation has relied on both quantitative and qualitative analysis, and data from a variety of sources including Ministry of Health ("MOH"), Accounting and Corporate Regulatory Authority ("ACRA"), Department of Statistics ("DOS"), telephone surveys of the dialysis centres and desktop research. Further details on the methodology used can be found at **Annex A**.

III.   NEW ENTRY AND EXPANSION

6.   To review CCS's assessment that barriers to market entry and expansion were not high in the Decision, we examined whether there was expansion and entry into the market. In this regard, we first examined the geographical spread of these newly set up centres. Second, we examined whether these new entrants and

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[2] CCS decision [400/008/12] on "Proposed Acquisition by Asia Renal Care (SEA) Pte. Ltd. of Orthe Pte. Ltd.", paragraph 29 to 37, page 9 and 10.
[3] CR3 refers to the market concentration of the three largest firms in the relevant market.
[4] CCS decision [400/008/12] on "Proposed Acquisition by Asia Renal Care (SEA) Pte. Ltd. of Orthe Pte. Ltd.", Table 2, page 14.

existing competitors' centres are "comparable" to the Parties' centres. To assess whether these centres are "comparable", we examined if these new centres achieved similar results, e.g. in terms of utilisation rates, as the Parties' centres, which indicates the extent to which these new centres impose competitive pressure on the Parties' centres in the market. We also examined the geographical spread of these new centres. Finally, we gauged how successful these new centres have been in gaining market share from existing players in the HD market.

<u>Number of Centres</u>

7.   At the nationwide level, we note that new players have entered the market and set up new centres after the merger. At the same time, existing players have also opened new centres.

8.   **Figure 1** shows that the number of centres in the HD market has increased from 39 in December 2012 to 60 in June 2015. Over the same period, the number of players has increased from 10 to 13, with ARC and Orthe merging into one, no exit of existing players and the entry of four new players in the market. In fact, existing players accounted for most of the increase in the number of centres, as the number of centres operated by existing players more than doubled from 13 to 28 while the Parties only added two more centres to its original pool of 26. The four new players, namely Advance Renal Care, Kidneycare, Pacific Advance Renal Care[5] and ARCA (Farrer Park) Dialysis[6], have set up one centre each.

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[5] Advance Renal Care (Asia) Pte Ltd holds a 50% stake in Pacific Advance Renal Care.
[6] ARCA (Farrer Park) Dialysis was listed on another competitor's (i.e., Advance Renal Care (Asia) Pte Ltd) website as one of its centres. However, we are unable to identify the ownership structure of ARCA (Farrer Park) Dialysis via ACRA.

Figure 1: Number of centres pre- and post-merger

Dialysis Centre Providers	No. of Centres	
	Pre-merger (Dec-12)	Post-merger (Jun-15)
Parties: ARC/FMC/Orthe/KTC	26	28
Existing competitors (Total)	13	28
ART/Immanuel/Renal Life	5	11
Renal Team Pte. Ltd. ("Renal Team")	1	6
Asia Kidney Centre[7]	2	5
B Braun	1	2
NUH Dialysis Centre	1	1
Renal Health (SGH)	1	1
Renal & Dialysis Clinic (S) Pte. Ltd.	1	1
Raffles Hospital	1	1
New entrants (Total)	N/A	4
Advance Renal Care	N/A	1
Kidneycare	N/A	1
Pacific Advance Renal Care	N/A	1
ARCA (Farrer Park) Dialysis	N/A	1
TOTAL	39	60

Source: MOH, ACRA, and CCS's telephone surveys

9.   The increase in number of centres by existing players and entry by new players post-merger supports CCS's conclusion that market barriers to entry and expansion were not high.

Location of new centres

10.   To assess whether different regions in Singapore experience similar entry as well as level of competition, we went on to analyse the HD market in various geographical regions of Singapore.

11.   In CCS's clearance decision[8], CCS agreed with the Parties' submission that the relevant geographic market was not wider or narrower than Singapore. CCS found that there were some centres that targeted affluent patients who resided in

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[7] Advance Renal Care (Asia) Pte Ltd holds a 51% stake in Asia Kidney Centre.
[8] Page 11 of Grounds of Decision issued by the Competition Commission of Singapore in relation to the notification for decision of the proposed acquisition by Asia Renal Care (SEA) Pte. Ltd. of Orthe Pte. Ltd. pursuant to section 57 of the Competition Act.

different regions of Singapore. For example, **Figure 2** shows that patients of Orthe's Lucky Plaza outlet resided in all parts of Singapore.

Figure 2: Locations of Patients for Orthe's Lucky Plaza Outlet

Source: Mapped by CCS based on Parties' submission in response to CCS's Request For Information during the merger assessment

12.   However, Chronic Kidney Failure Stage 5 ("CKD5") patients that need HD treatments generally require two to three HD treatments a week, each time spanning four to five hours. Hence, there is an argument for CKD5 patients to be more location-sensitive, and that convenience will be part of their consideration when selecting a centre for HD services.

13.   This is supported by **Figures 3 to 6** which were mapped out by the merger case team based on data submitted by the Parties in response to CCS's Request For Information during the assessment of the merger. They showed that there were centres providing HD services which had most of their patients living around the vicinity of these centres.

Figure 3: Locations of Patients for RTC Jurong

Location of RTC Jurong

Figure 4: Locations of Patients for ARC Kembangan

Location of ARC Kembangan

Figure 5: Locations of Patients for RTS Ang Mo Kio
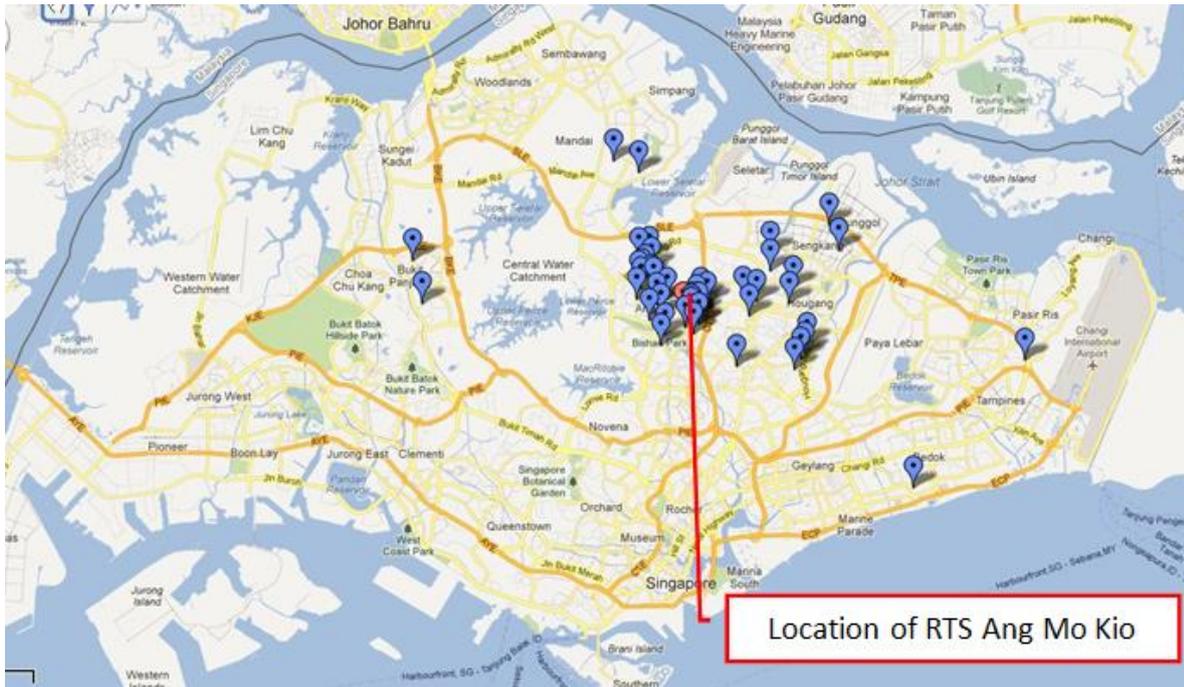
**Figure 6: Locations of Patients for KTC Marsiling**

Source of Figures 3-6: Mapped by CCS based on Parties' submission in response to CCS's Request For Information during the merger assessment

14.   Responses obtained from third-parties during the public consultation phase of the merger assessment also suggested that many patients prefer to dialyse at a centre near their home. One respondent noted that if patients were given a choice, they would not want to travel more than two to three kilometers from their home. However, if there is public transport available, e.g. Mass Rapid Transit ("MRT") train services or direct bus services, patients may be prepared to travel further. Another respondent noted that patients prefer their dialysis centre to be as close to their homes as possible and there are patients on waiting list to be transferred to a dialysis centre near their home. The respondent had therefore located his dialysis centres in the heartlands where public transportation is very accessible.

15.   In view of the information above, we consider that there is good basis to assess entry and exit at the regional level as well for the purposes of this evaluation. In **Figure 7**, the blue pins and yellow pins, representing ARC and Orthe respectively, collectively represent the Parties' centres pre-merger while the red pins represent their competitors' centres pre-merger. The blue squares and the red squares represent new centres set up by the merged Parties and existing competitors' post-merger respectively. The green squares represent entry by new entrants post-merger.

Figure 7: Regional Locations of HD Centres (as of June 2015)
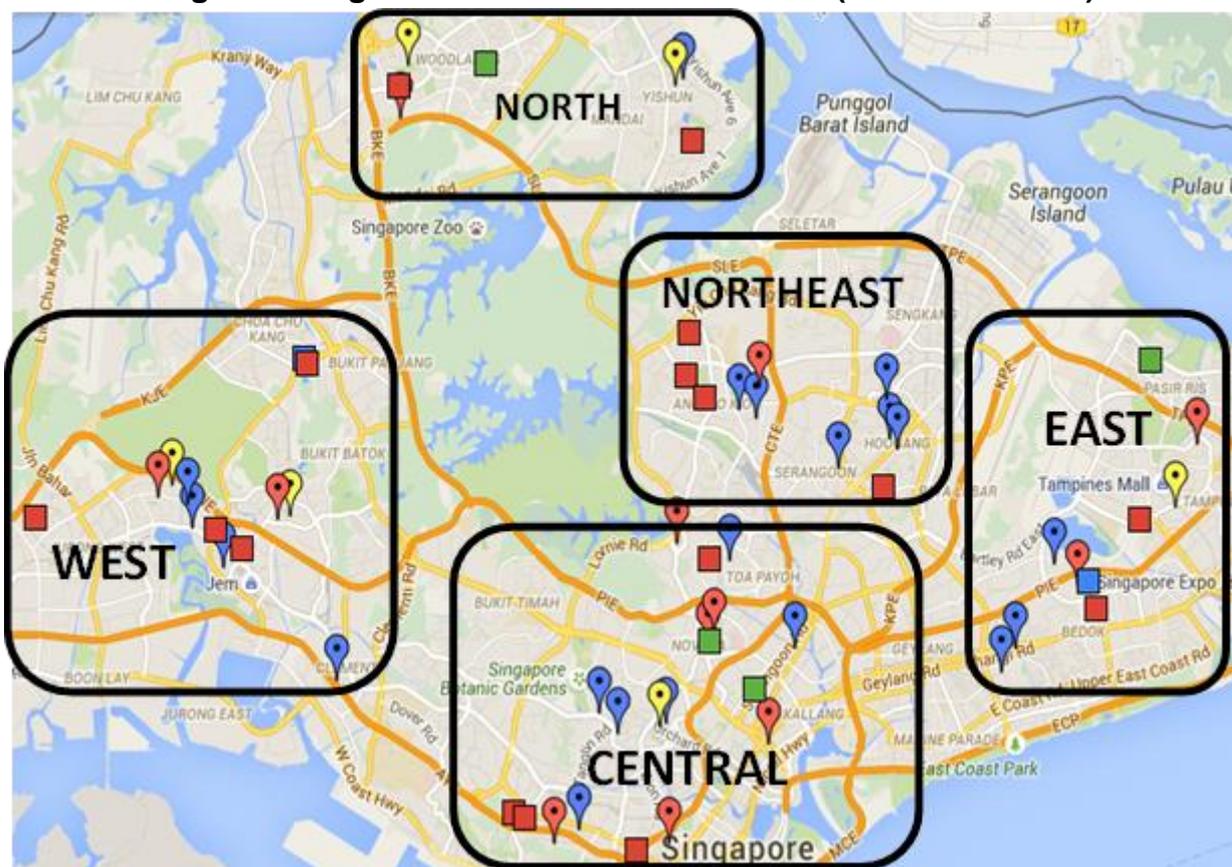
Source: Location of all centres and their operators are provided by the MOH

16.   For the regional analysis of the HD market, the market is divided into smaller regions namely, North, Central, East, West and Northeast. The demarcations follow URA's planning boundaries.[9]

17.   At the regional level, we note that there are new centres operating in the HD market across all regions, suggesting an increase in competition in every region.

Capacity Increase Contributed by Competitors

18.   Centre capacity is estimated by the number of patients that a centre can serve during a single work week.

19.   We observe from **Figure 8** below that the nearly 50% increase in total capacity (in terms of number of slots) can be attributed mostly to the increase in competitors' capacity. As most of the new centres are operated by the competitors, the competitors' capacities have more than doubled since 2013. However, we note that one of the centres operated by B Braun is ceasing operations due to the end of the lease.[10]

Figure 8: Total Capacity of Outpatient Private HD Market (based on number of slots)
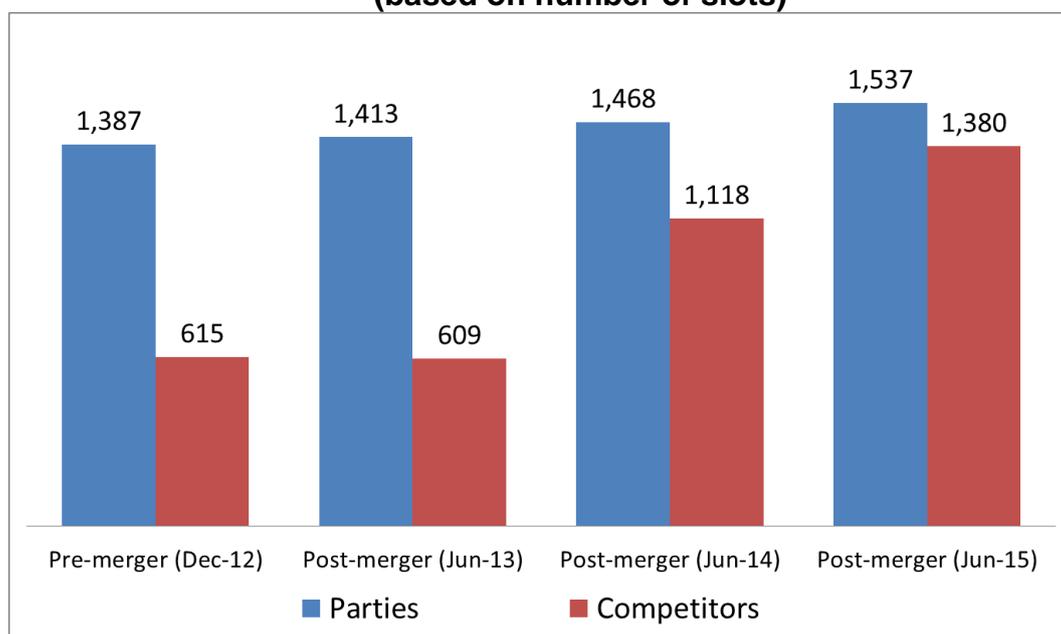
Source: CCS's telephone surveys

20.   We further examine the increase in competitors' capacity in terms of increase by existing competitors and by new entrants. As shown in **Figure 9**, there has been a sharp increase in capacity by both existing competitors and new entrants from

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[9] http://www.ura.gov.sg/uol/master-plan/Contacts/View-Planning-Boundaries.aspx.
[10] Based on CCS's telephone surveys, the phone line of B Braun Avitum Dialysis Centre outlet at Irrawaddy Road was no longer in use suggesting that the centre had ceased operations.

June 2014 onwards. This increase in capacity is expected to continue in the near future as some centres have yet to be equipped with the maximum number of machines approved by MOH.

Figure 9: Total Capacity of New Entrants and Existing Competitors
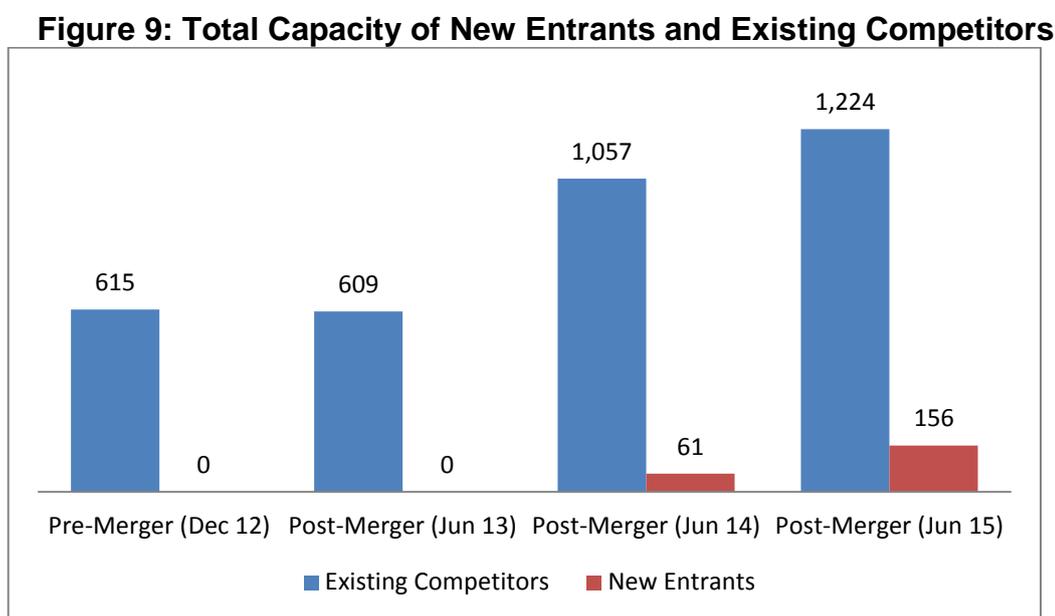
Source: CCS's telephone surveys

Comparable Utilisation Rate between New and Existing Centres

21.   As defined in the methodology section, the minimum utilisation rate is obtained by taking the estimated minimum number of patients and dividing them by the estimated capacity in each dialysis centre. It proxies the level of usage of the HD machines in a centre, to complement the data on entry and expansion of centres. The minimum utilisation rate is being used for the comparison here instead of the maximum utilisation rate because the former is likely to be a better estimate of the actual utilisation rate given that there are many newly setup centres which will take time to attract customers, and thus the actual number of patients and utilisation rate in the centre will be relatively lower. Therefore, the minimum utilisation rate will be a better estimate than the maximum utilisation rate.

22.   Based on the information gathered through the telephone surveys, we note that competitors have attained comparable utilisation rates as the Parties post-merger, and have in fact overtaken the Parties in June 2015 (see **Figure 10**).

23.   In particular, we notice that the utilisation rates for the Parties have been falling post-merger, with a particular sharp fall in June 2014. This may be a result of more intense competition by existing competitors' centres, and the sharp influx of new centres setting up and commencing operations in 2014. The sharp fall in utilisation rate is also observed for the competitors in 2014 (see **Figure 10**).

Figure 10: Utilisation Rates of Parties and Competitors

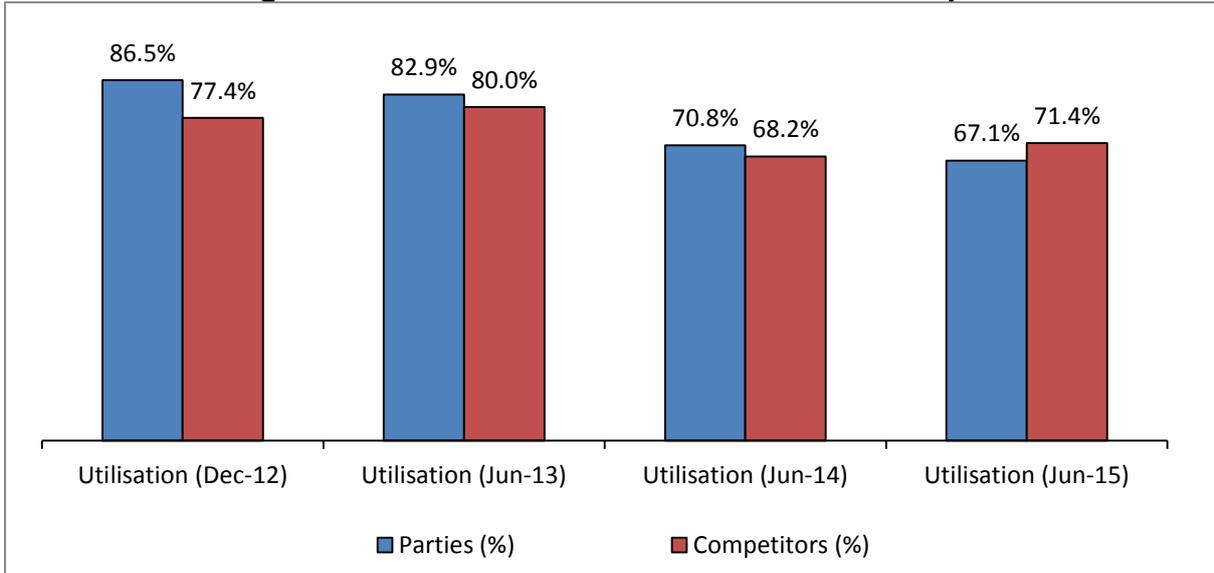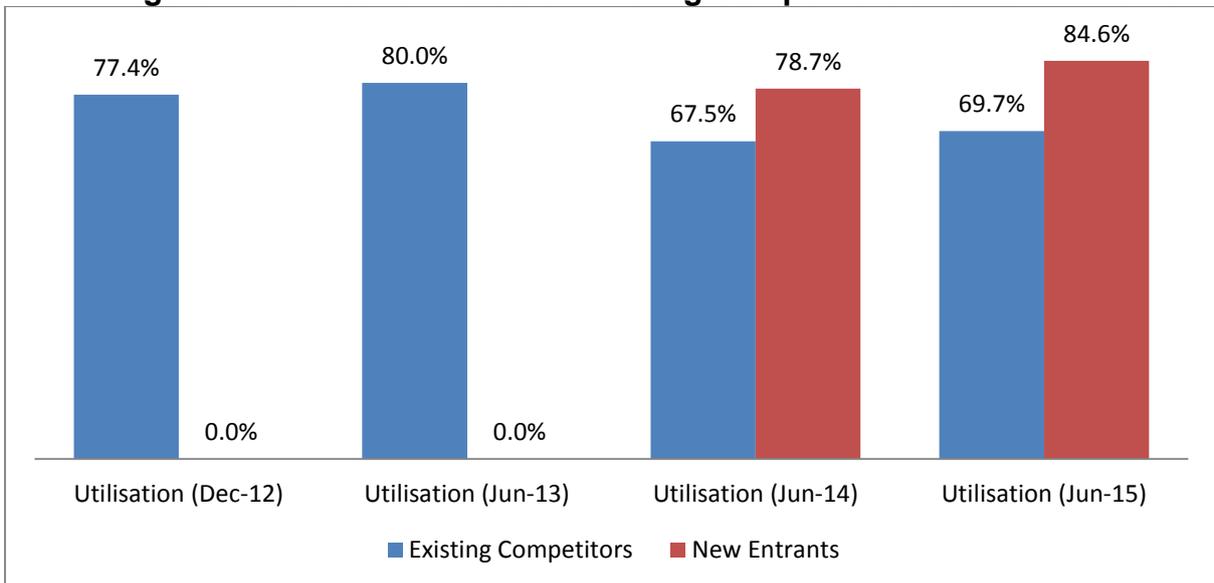|	Parties (%)	Competitors (%)
Utilisation (Dec-12)	86.5%	77.4%
Utilisation (Jun-13)	82.9%	80.0%
Utilisation (Jun-14)	70.8%	68.2%
Utilisation (Jun-15)	67.1%	71.4%

Source: CCS's telephone surveys

24.   **Figure 11** shows the breakdown of utilisation rates by existing competitors and new entrants. Of particular interest is the utilisation rate for new entrants. Despite being new to the HD market, the new entrants have achieved a utilisation rate that is comparable to the existing players.

Figure 11: Utilisation Rates of Existing Competitors and New Entrants

|	Existing Competitors	New Entrants
Utilisation (Dec-12)	77.4%	0.0%
Utilisation (Jun-13)	80.0%	0.0%
Utilisation (Jun-14)	67.5%	78.7%
Utilisation (Jun-15)	69.7%	84.6%

Source: CCS's telephone surveys

Gain in Market Share by Competitors

25.   Arguably, the most observable effect of expansion and entry (mostly made by competitors) is the market share that competitors have gained from the Parties. We

observe that market share (by estimated number of patients) of the Parties have declined significantly.

26.   Referring to **Figure 12**, we observe that the Parties' market share has decreased from 69.7% to 52.7%, a dip of 17.0% over the 30-month period.

Figure 12: Market Share by Estimated Number of Patients[11]
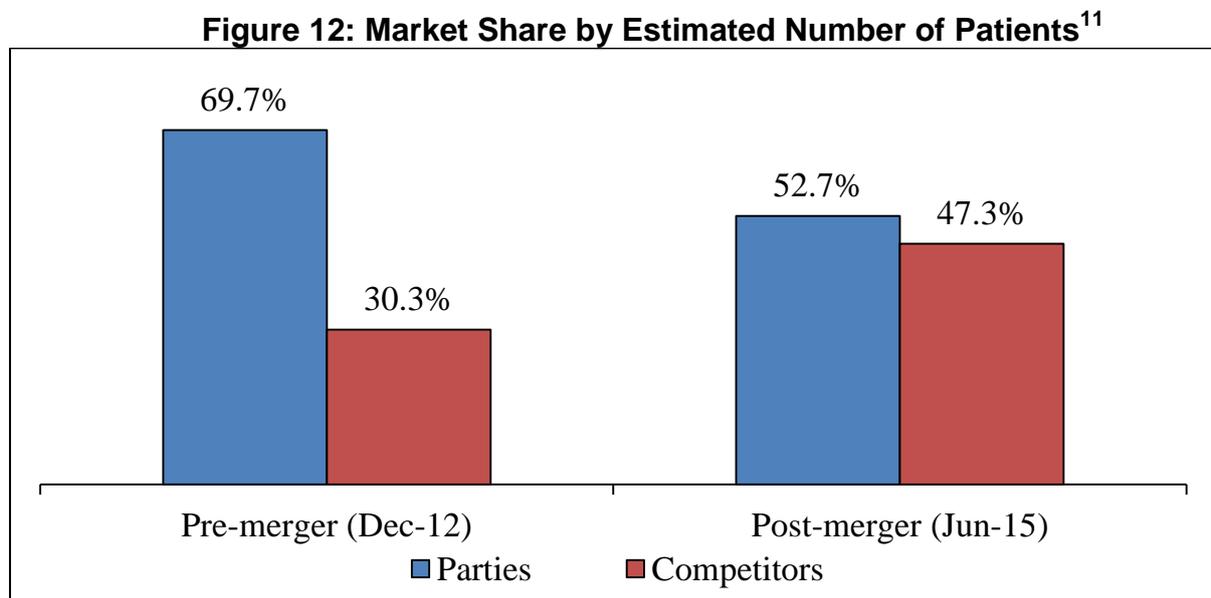
Source: CCS's telephone surveys

27.   **Figure 13** shows the change in market shares for all players in the HD market. Given the decrease in Parties' market share, together with the fact that five existing competitors had expanded their market shares and four new competitors had entered the HD market during this period, this supports the view that competition in the HD market has not been adversely affected.

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[11] Estimated maximum number of patients.

Figure 13: Market Share by Estimated Number of Patients[12]

	Pre-merger (Dec-12)	Post-merger (Jun-15)
Parties: ARC/FMC/Orthe/KTC	69.7%	52.7%
ART/Immanuel/Renal Life	10.0 %	13.6%
Renal Team Pte. Ltd. ("Renal Team")	0.7%	8.2%
Asia Kidney Centre	6.2%	9.6%
B Braun	2.5%	3.9%
NUH Dialysis Centre	4.5%	2.5%
Renal Health (SGH)	5.5%	2.5%
Renal & Dialysis Clinic (S) Pte. Ltd.	0.0%[13]	0.5%
Raffles Hospital	0.9%	1.0%
Advance Renal Care	0.0%	1.7%
Kidneycare	0.0%	1.7%
Pacific Advance Renal Care	0.0%	0.8%
ARCA (Farrer Park) Dialysis	0.0%	1.2%
Competitors:	30.3%	47.3%
Total	100.0%	100.0%
CR3	79.7%[14]	76.0%[15]

Source: CCS's telephone surveys

28.   The CR3[16] had also decreased over the 30-month period from 79.7% to 76.0%. While the net decrease appears not to be significant, this figure is understated due to the nature of the calculation of CR3. Pre-merger, the CR3 (at 79.7%) included the market shares of ARC and Orthe, and another competitor. Post-merger, the CR3 (at 76.0%) included the Parties (as a single entity) and two other nearest competitors into the calculations. Essentially, this means that we are comparing the combined market share of the three largest players pre-merger to the combined market share of the four largest players post-merger. Thus, this underscores the fact that the market shares of the Parties had significantly fallen.

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[12] Estimated maximum number of patients.

[13] Renal & Dialysis Clinic (S) Pte. Ltd. had just entered the market in end 2012 and was still in the midst of setting up its centre.

[14] ARC/FMC + Orthe/KTC + ART/Immanuel/Renal Life

[15] ARC/FMC/Orthe/KTC + ART/Immanuel/Renal Life + Asia Kidney Centre

[16] The CR3 used here is the combined market share of the 3 largest players by estimated maximum no. of patients. The results are consistent when calculating by estimated minimum no. of patients or when calculating by no. of outlets.

IV.   MERGER'S IMPACT ON PRICES

No Adverse Impact on Regional Average Prices due to Merger

29.   We conducted quantitative analysis based on regional average prices. Based on our quantitative analysis, there is no conclusive evidence that the merger has had any adverse impact on average prices of HD services. The results are derived from the DID estimation model where the details of the model can be found in **Annex B**.

30.   Based on **Figure 14** it is noted that the coefficient for Merger Effect variable, which isolates and measures the effects of merger, is statistically insignificant.[17] This remains so when additional controls such as number of entrants and proxies for quality are added for robustness checks. The DID estimation results therefore suggest that there is insufficient evidence to show that the merger has had any adverse impact on average prices of the HD market.

Figure 14: DID Results (including controls)

DID Results

	Price	Price	Price	Price
Merger Effect	**-4.145**	**-1.723**	**-1.463**	**-1.436**
	(6.979)	**(6.899)**	**(7.755)**	**(7.753)**
Time	4.5	2.575	2.369	5.056
	(1.878)	(2.919)	(5.487)	(5.998)
Treatment	23.395	19.672	22.615	22.576
	(6.253)***	(5.894)***	(7.181)***	(7.192)***
Constant	181.667	163.760	151.477	151.277
	(0.971)***	(5.902)***	(7.234)***	(7.217)***
Controls				
Quality		30.456	33.721	34.055
		(9.679) ***	(8.407) ***	(8.347)***
Doctor (75%)			31.089	31.100
			(4.640)***	(4.633)***
Entrants				-0.256
				(0.220)
N	222	222	222	222

Note:* $p<0.1$; ** $p<0.05$; *** $p<0.01$

Standard Deviations of the coefficients are indicated in brackets

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[17] For the purpose of performing the DID analysis, we compared price of High Flux Single Use dialysis sessions for the same group of centres before and after the merger. This is to guarantee the accuracy of the DID estimate. The results do not differ when the analysis takes into account new centres that are set up post-merger (i.e. the Merger Effect variable remains statistically insignificant suggesting that there is insufficient evidence to show that the merger has had any adverse impact on average prices of the HD market).

Source: CCS's telephone surveys

Negligible Change in Nationwide Average Price Levels

31.   The above analysis was conducted based on regional average prices. We also conducted our analysis based on nationwide average price trends. The Medical & Dental Treatment Index[18] ("MDTI") is a component of the DOS's Consumer Price Index. Dialysis treatment costs are included within the MDTI calculation, along with other treatment procedures.[19] The MDTI is used in this case as a proxy for inflation of costs of HD services.

32.   The average price of HD services[20] moved in the same direction with the MDTI from December 2012 to June 2015 with the sole exception being in the period between January 2014 and June 2014 where the average price of HD services fell while MDTI continued to increase **(Figure 15)**. We also observed that the overall rate of increase in MDTI was greater than the overall rate of increase in average prices of HD services (comparing between December 2012 and June 2015). In fact, there was no net change in the average price of HD services over the 30-month period, whereas the MDTI had an overall net increase. This could be due to the increased competition (via 15 new centres being set up and operationalised in the year 2014) in the HD market overwhelming the upward inflationary pressure on prices.

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[18] MDTI data are obtained from the SingStat Table Builder and figures are tabulated to base against the December 2012 figures.
http://www.tablebuilder.singstat.gov.sg/publicfacing/mainMenu.action
[19] Information on Prices Statistics, Rebasing of the Consumer Price Index (Base Year 2014 = 100), Department of Statistics.
http://www.singstat.gov.sg/docs/default-source/default-document-library/publications/publications_and_papers/prices/ip-e44.pdf.
The MTDI information is retrieved from the Department of Statistic's table builder available on their website.
[20] Average prices for HD services are obtained by averaging the price quoted by the dialysis centres during the telephone surveys.

Figure 15: HD Average Price vs. Medical & Dental Treatment Index (Base month Dec 2012 = 100)
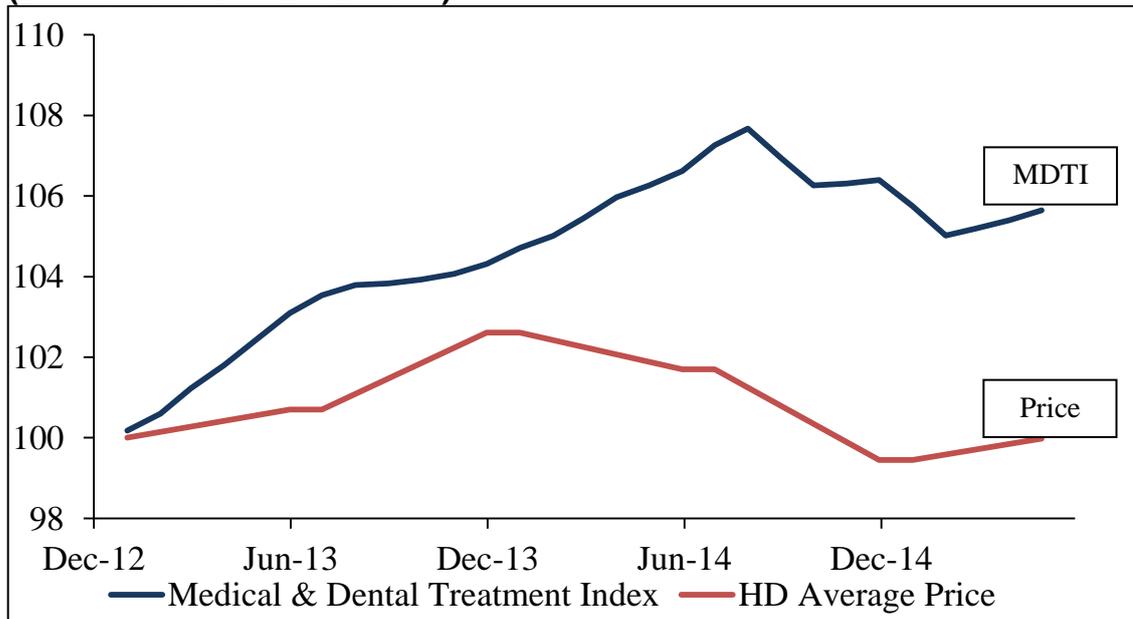
Source: DOS, CCS's telephone surveys

V. LIMITATIONS

33. Notwithstanding our best effort to ensure that the above results are as reliable as possible, there are several inherent limitations to the study.

34. First, by nature of the telephone survey approach used to collect information, the consistency of the data collected across centres and over the 30-month period may be called into question. For example, different personnel were likely to have answered our call and might have interpreted our queries differently. In addition, the method used to estimate maximum and minimum utilisation rate, while useful to mitigate the lack of precise information, necessarily involves a degree of uncertainty.

35. Second, as we do not have access to market data before the merger was notified, we were not able to conduct a more in-depth comparison of patient count and prices before the merger.

36. Third, while attempts have been made to control for the effects of other factors that could have affected prices (such as quality), there could be other factors that have not been accounted for. One example could be demographic changes, which could have affected both prices and the decision by the parties to merge, but not factored into the regression analysis due to lack of data and good proxies.

VI. CONCLUSION

37.   In conclusion, within the scope of the evaluation undertaken in this study and based on the selected methodology, our findings suggest that following CCS's Decision on 26 December 2012, the acquisition has not led to a substantial lessening of competition in the market.

38.   In particular, existing players have expanded the number of centres, and new players have entered the market, suggesting that market barriers are indeed not high. These new centres have also managed to perform comparably well compared to existing centres owned by the Parties based on their average utilisation rates. In terms of prices, at the nationwide level, average prices for HD services have not increased even though the inflation proxy, MDTI, has. Comparing across regional markets within Singapore, we were not able to observe a significant increase in prices due to the merger.

Detailed Methodology

1.   In formulating the methodology of the post-action evaluation, we took reference to the framework developed by Professor Stephen Davis[21] for CCS to evaluate past interventions. In his paper[22], Professor Davis recommended that any post-enforcement evaluation should be done at least two to three years after CCS's intervention to sufficiently capture market changes thereafter. Further, he recommended that quantitative methods such as difference-in-differences analysis ("DID")[23] and before-and-after analysis[24] should be used by default when evaluating CCS's intervention.

Market Definition

2.   For the purpose of this post-action evaluation, we assessed the HD market based on two different geographical definitions – whole of Singapore as a single HD market as per the clearance decision, and separate regional markets within Singapore. The purpose of adding in the latter is to provide for a more rigorous and in-depth analysis on the HD market.

Sources of information

3.   In the course of the post-evaluation study, we obtained from the Ministry of Health ("MOH") biannually the list of approved dialysis centres in Singapore, which also contains the maximum number of dialysis machines that each centre is allowed to operate. Ownership and other details of new dialysis centres were obtained from the Accounting and Corporate Regulatory Authority ("ACRA"). Telephone surveys were conducted with every centre on the list on a biannual basis to confirm that the centres are in operation and to collect the required information.

Estimating capacity of each dialysis centre

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[21] Stephen Davies is Professor of Economics and one of the four founders of the ESRC Centre for Competition Policy at the University of East Anglia. He has previously acted as an Academic Adviser to the UK Office of Fair Trading, and has undertaken research for, and advised various other competition and governmental bodies in both the UK and overseas.

[22] Post-Enforcement Evaluation Methodologies and Indicative Findings, Professor Stephen Davies https://www.ccs.gov.sg/~/media/custom/ccs/files/media%20and%20publications/publications/occasional%20paper/ccs%20post%20enforcement%20evaluation%20-%20uploaded%20270813.ashx

[23] DID is a quasi-experimental econometric technique involving a comparison of prices before and after an event relative to some other real world control, i.e. a similar market without the event or within the same market for firms not involved in the event.

[24] This methodology is a simple comparison of difference between the situation before an event and the effects thereafter. For mergers, the method is a simple comparison of prices before the merger with prices after the merger. In order to control for exogenous factors during the assessment period, the analysis should ideally include other variables such as demand growth, inflation, capacity utilisation, etc.

4.   Through the telephone surveys, we obtained the number of dialysis machines used in each dialysis centre and the centre's operating hours. We found that dialysis centres typically offer patients sessions regularly spaced-out in the week. For example, a patient typically gets allocated sessions on Monday-Wednesday-Friday, or on Tuesday-Thursday-Saturday, and cannot choose to have dialysis service on Monday-Tuesday-Wednesday. Further, a patient is typically required to have all sessions at the same time of the day, e.g., only in the mornings, afternoons, or evenings. Dialysis centres would typically not allow patients to have a mix of sessions at different times of the day.[25] Based on the information obtained, we estimated the capacity of each dialysis centre on a weekly basis.

Estimating number of patients in each dialysis centre

5.   Through the telephone surveys, we were only able to obtain information on whether there are slots available for the shift. Based on the information regarding slots availability, we estimated the possible number of patients using each centre (within the range of a minimum and a maximum number). To estimate the maximum number, we assume that if a slot is available, that it is the last slot available for a particular shift. To estimate the minimum number, we assumed if a slot is available, that all slots are available on a particular shift, i.e., no patient is using any of the slots.

Estimating capacity utilisation at each dialysis centre

6.   We obtained the minimum and maximum utilisation rate for each centre by dividing the estimated minimum and maximum number of patients with the centre's capacity. The estimated utilisation rates indicate if each centre is running at full capacity. The comparison of utilisation rates across different centres over time may indicate if each centre is facing competitive pressure from the others.

Estimating the prices of HD treatment at each dialysis centre

7.   For the purpose of this study, we track prices of dialysis treatment which uses Single Use dialyser and High Flux membrane, as it is the type of treatment most commonly provided by dialysis centres.

8.   Dialysis centres generally charge different prices for treatments using single-use or reused dialysers. The dialyser is the piece of equipment that filters the blood. The dialyser may be discarded after use (single-use dialyser) or to be cleaned and reused (reused dialyser). Based on preliminary calls, some dialysis centres in Singapore do not offer reused dialyser services.

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[25] We also found via telephone surveys that dialysis centres do not generally allow patients to receive treatment in more than one dialysis centre, even if they are under common ownership or control.

9.   Dialysis centres generally charge different prices for treatments using dialyser membranes of different pore size, namely Low Flux or High Flux dialyser membranes. Low Flux dialyser membranes are those with smaller pore size, and High Flux with higher pore size. There is currently no medical criterion for the use of Low Flux or High Flux dialysers, unless specified by a renal physician based on the patient's medical condition.[26] The current trend among dialysis centres is towards using High-Flux dialysers. Based on preliminary calls made, some dialysis centres in Singapore no longer offer Low Flux dialyser services.

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[26] Research has shown that the use of High-Flux dialysers is beneficial for high-risk dialysis patient groups.

Difference-in-difference model specification

1.   To investigate the impact of the merger on regional prices, we employed the DID Estimation approach. The DID approach is used to isolate and estimate the impact of the merger on the prices.

2.   The DID approach, in the context of evaluating the impact of this merger, involves comparing the average prices of two groups of dialysis centres - the control group (which has not been affected by the merger) and the treatment group (which has been affected by the merger) – over two periods, one before and one after the merger. In particular, it compares the difference between the average price increase of the treatment group and the average price increase of the control group.

3.   This double differencing allows us to remove both group-specific effects and time-specific effects. Examples of group-specific effects include the fact that one of the groups may only include dialysis centres that are located in mature estates[27] where prices of HD treatment may differ as compared to new estates. Examples of time-specific effects include increases in costs that affect all dialysis centre providers, and increases in demand for treatment due to higher incidences of end-stage renal disease. However, where possible, the effects of other factors that systematically affect differences between the sample before the merger and the sample after the merger within the same group should be taken into consideration by including relevant explanatory variables. Examples include increases in costs that affect certain locations but not others.

4.   The centres are divided into either the treatment group or the control group. We identify dialysis centres within four areas (WEST, EAST, NORTH, and CENTRAL) as the treatment group (see **Figure 16**). In identifying each area, we took reference to the patient locations of the sample of dialysis centres provided by the Parties during the merger assessment. These four areas are identified as being within the treatment group as they each contain at least one ARC/FMC centre *and* at least one Orthe/KTC centre that compete pre-merger, but not post-merger.

5.   Centres in NORTHEAST are identified as being within the control group (see **Figure 16**). NORTHEAST is identified as being within the control group because it does not contain at least one ARC/FMC centre *and* at least one Orthe/KTC centre. Hence, competition within NORTHEAST is not expected to be affected by the merger.

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[27] According to HDB, mature estates are generally established towns with many amenities, and have little land to build HDB flats. For non-mature estates, they have fewer amenities and have much more land available to develop and build HDB flats.

Figure 16: Treatment and Control Groups
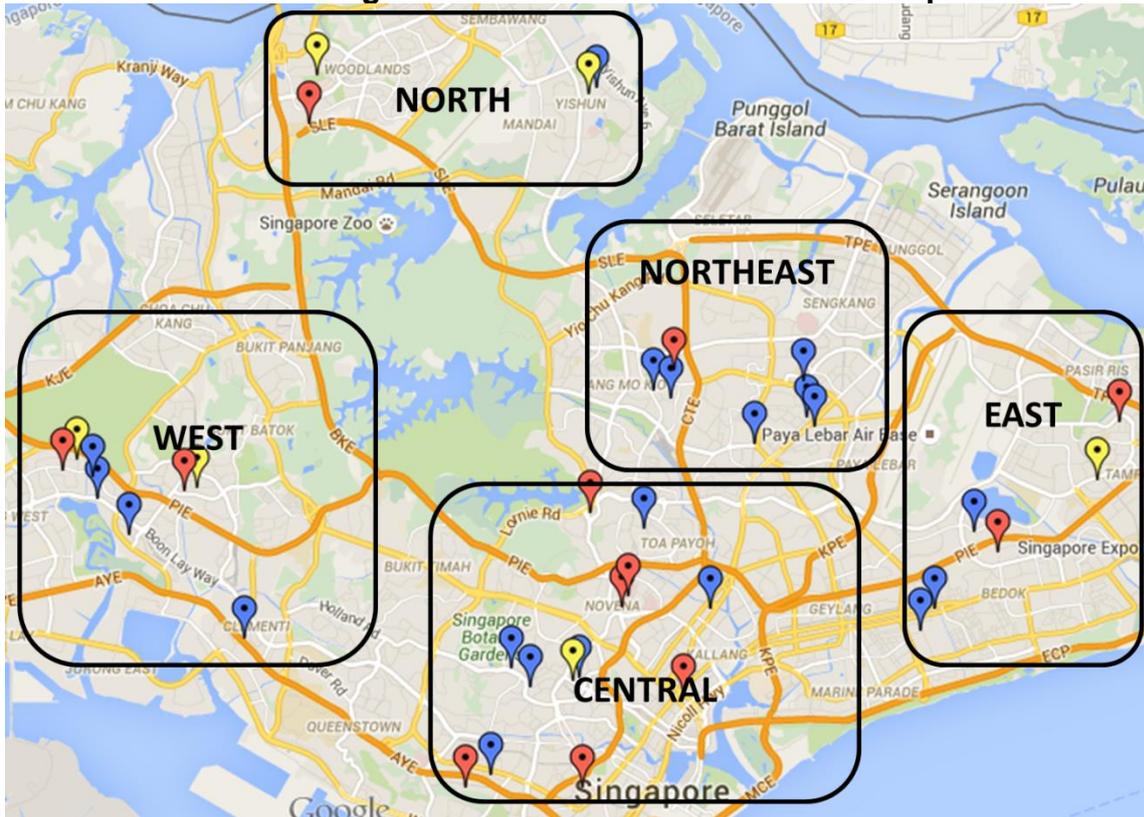
Source: MOH

6.   For the purpose of performing the DID analysis, we compared price of High Flux Single Use dialysis sessions for the same group of centres before and after the merger.

7.   One of the most important assumptions of the DID model is that both the treatment and control group are similar. It is noted prior to the merger, both groups have a good mixture of centres in mature estates (with higher-than-average densities of aged population) as well as in newer estates, and hence are similar.

8.   Another assumption of the DID model is that but for the event of the merger, average prices in the treatment group will have moved in tandem with the average prices in the control group. (A weaker assumption is that both groups will generally follow the same price trend.) That is, given that centres in both groups have similar characteristics (i.e. similar residential population makeup in the areas), the deviation in prices can be largely attributed to the event of the merger.

9.   As seen in **Figure 17**, we see that there has been deviation of the actual average prices (red solid line) in the treatment group, away from the expected parallel price movements of the hypothetical treatment group (red dotted line). This suggests that the merger may have had some form of impact on average prices of

the centres in the treatment group. Nonetheless, that requires us to determine if such impact is statistically significant.

Figure 17: Price Levels of Control and Treatment Groups
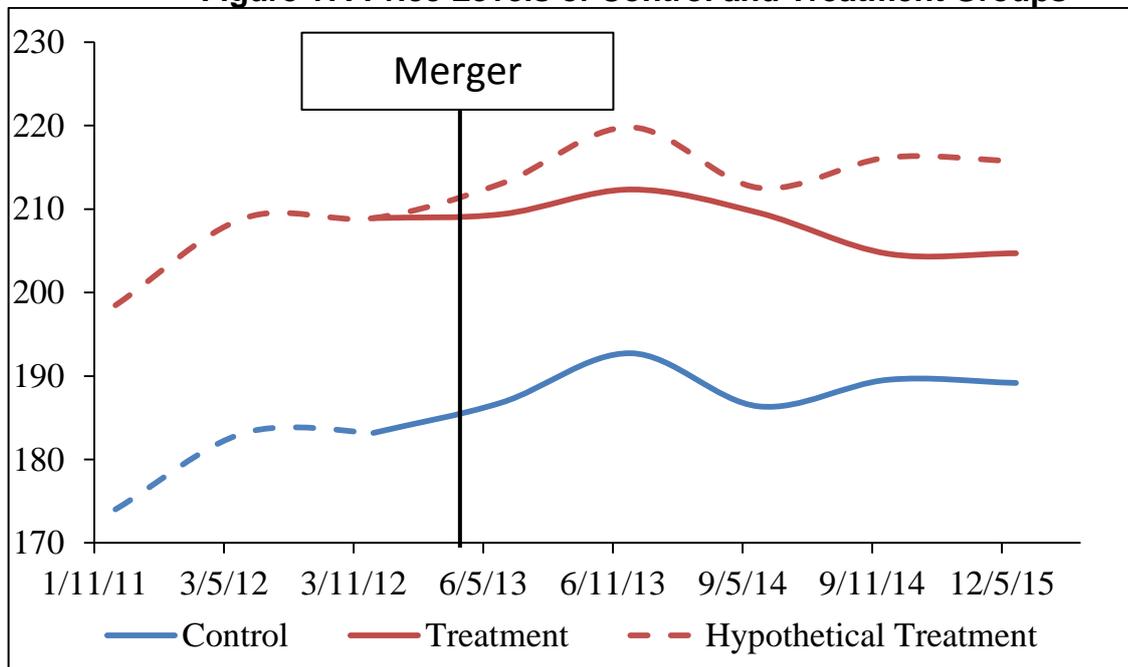
Source: CCS's telephone surveys

10.   Hence, the following equation is the basic form for the DID estimation:

$$Price_{it} = \alpha + \beta_1 Time + \beta_2 Treatment + \beta_3 Time * Treatment + \beta_4 controls_{it} + \epsilon_{it}$$

The *Time* variable is a dummy variable which indicates 0 for pre-merger and 1 for post-merger (i.e., after December 2012)

The *Treatment* variable is a dummy variable which indicates 0 for control group and 1 for treatment group.

The *Time*Treatment* variable also known as the **Merger Effect** variable is the interaction between the *Time* and *Treatment* variables which indicates 1 for the effects of merger on the treatment group post-merger and 0 otherwise.

The $controls_{it}$ variable is a vector of controls for example the number of entrants each year, a centre's nurse-to-machine ratio (quality) and a doctor's ability (quality) for centre *i* in time period *t*.

ϵ_{it} is a random error associated with centre *i* in time period *t*.

11.   The interpretation of the *Time* coefficient β_1 is the difference in average price across the two time periods pre-merger and post-merger[28]. For the *Treatment* coefficient β_2, it represents the difference in average price between the treatment group and control group.[29] Lastly, the *Time*Treatment* coefficient β_3 is the most important of all for the DID estimation as it represents the change in average prices in the areas affected by the merger in the post-merger period. **In essence, β_3 indicates the impact of merger on average prices and we would consider a positive and statistically significant estimate to suggest an adverse impact on prices.**

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[28] This captures the impact of any factor(s), other than the merger, that might also have changed post-merger and affected prices.
[29] This captures the impact of any factor(s), other than the merger, that affected prices of the treatment and control groups differentially, both before and after the merger.

Summary of Peer Review Report on
"Post-Action Evaluation of CCS Merger Clearance in the Dialysis Market"

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I. INTRODUCTION

1. The Competition Commission of Singapore ("CCS") conducted a post-enforcement evaluation study of the market for outpatient haemodialysis treatment to non-subsidised patients in Singapore ("HD market") (the "Study"). The Study was done by the CCS's post-evaluation study team ("team") and covered the time period from December 2012 to June 2015 (the "Period"). The Study aimed to answer the following two questions: 1) Did entry and expansion take place in the HD market following CCS's Decision to clear the proposed acquisition by Asia Renal Care (SEA) Pte Ltd of Orthe Pte Ltd? 2) Did the merger have any adverse effect on prices?

2. The purpose of this peer review is to provide an independent evaluation of the Study. More specifically, I comment on the methodology and findings of the Study. I also suggest some improvements for future studies.

II. METHODOLOGY

3. The team used the following quantitative methods for the Study:
    a. Before-and-after analysis;
    b. Difference-in-Difference (DID) analysis.

4. In order to apply the quantitative methods, the team collected data from a number of secondary sources and also collected its own primary data by calling various dialysis centers in Singapore. These telephone surveys generated data on prices, number of dialysis machines and operating hours for each dialysis center at six-month intervals within the Period.

5.   The team's choice of the quantitative methods for the Study was appropriate. Given the nature of the market and available data, the other quantitative methods—like event study analysis and simulations based on a structural model—were not feasible. Also, due to the homogenous nature of the service provided by the HD market, the before-and-after and DID analyses were enough to answer the questions in paragraph 1 above.

6.   I appreciate the team's efforts to collect primary data at regular intervals through the tedious process of conducting telephone surveys. These efforts generated valuable information for the Study.

III. RESULTS

7.   The Study found (see Figure 1 in the Study) that there was a substantial increase in the overall supply of HD services in Singapore and that the merging parties lost market share over the Period. The Study also found that the increase in the number of dialysis centers was spread across the five major sub-regions of Singapore.

8.   Figure 10 suggests that the capacity utilization decreased for the merging parties as well as their competitors and more so for the former. This is a sign of healthy competition and is likely to have improved patient welfare by making it easier for patients to get a time slot of their choice.

9.   Based on the information from Figure 13, the team's finding that CR3 had decreased further shows that the competition in the HD market has increased since the time of the merger.

10. Despite some measurement issues about capacity, the data provide convincing evidence that there was enough entry and expansion in the HD market over the Period. This result is in line with the CCS's expectations at the time of the Decision.

11. Here an important question is: had the CCS not allowed the merger, how would the number of dialysis centers catering to the HD market in Singapore have evolved? Although the Study cannot provide a definitive answer to this question, my best guess based on the numbers reported in the Study is that the number of centers

would likely have evolved in a very similar way. In other words, the Decision did not affect the evolution of the HD market structure over the Period.

12. The second set of results in the Study aim to answer the second question in paragraph 1 above. These results are reported in Section IV of the Study.

13. The first important result about prices is reported in Figure 15. The figure shows that the average price of HD was more or less unchanged over the Period despite the fact that the Medical and Dental Treatment Index compiled by the Singapore Department of Statistics showed an approximately 6% increase over the Period. This result provides preliminary evidence that the Decision did not lead to any discernible increase in the price of HD.

14. More convincing results about the absence of any increase in prices due to the Decision are in Figure 14. The figure reports the results of DID regressions. The regressions controlled for a number of confounding effects and found that the net effect of the decision on HD prices was negative and statistically insignificant.

15. The results discussed in the preceding paragraphs (from 12 to 14) answer the second question in paragraph 1 above. They show that there was no increase in the price of HD over the Period.

16. Once again an important question is: had the CCS not allowed the merger, how would the price of HD have evolved over the Period? Once again my guess is that the evolution of prices would not have been any different.

IV. SUGGESTIONS FOR IMPROVEMENT

17. In this section I make some suggestions to improve this study and similar studies in the future. I shall start with what I consider to be the major suggestions and gradually move towards the less important ones.

18. As acknowledged by the team in Section V of the Study, a limitation of the Study is the method to calculate the range of utilization rates (i.e., by estimating the minimum and maximum utilization rates). As the range is wide, it does not tell much about the actual capacity utilization. However, if one could devise a way to independently confirm the Study's findings about the utilization rates, it would add to

the credibility of the Study. By using the change in number of dialysis patients and the change in maximum capacity of centres, I independently estimated the increase in demand and the increase in supply on a yearly basis respectively, and in turn estimated the change in relative capacity utilization over the Period.

19. The Study's estimate of the relative capacity utilization is close to my independent estimate. Hence, despite using an unproven method to estimate capacity utilization, the Study's estimates are quite reasonable.

20. Other suggestions to improve the Study include:

    a. Discussing on the types of competition (e.g., prices, quality, location etc) being played in the HD market;

    b. Plotting of the average prices charged by the parties and their competitors;

    c. Using of 'Doctor Experience'[30] instead of 'Doc75'[31] in the regressions as the variable entitled 'Doc75' used in the DID regressions contains less information than the variable entitled 'Doctor Experience' in the data file;

    d. Computing of the Herfindhal-Hirschman Index (HHI) which is a more comprehensive measure of the level of competition in a market than CR3 or similar other ratios; and

    e. Reporting R-squared statistics as part of the regressions results in Figure 14 as R-squared is an important statistic that summarizes how much of the variation in the dependent variable can be explained by the independent variables.

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[30] 'Doctor Experience' refers to the centre doctor's years of experience.
[31] 'Doc 75' is a dummy variable where '1' means the centre doctor's experience is higher than the 75th percentile when the all centre doctors are ranked according to their years of experience and '0' means the centre doctor's experience is within the 75th percentile when the centre doctors are ranked according to their years of experience.

V. CONCLUSION

21. The Study uses standard methodologies and provides convincing evidence that the Decision did not have any adverse effect on competition in HD market for patients. I agree with the overall methodology of the study and find its results quite reasonable and well supported by evidence.

22. I have made some suggestions to improve the Study and similar studies in the future. Most of my suggestions are minor and even in its present form the Study serves its purpose well.