I INTRODUCTION

1. Cataract surgery is usually a non-emergency day surgery, which is carried out under local anaesthesia and does not require the patient to stay in hospital. Occasionally patients with cataract may also have other pre-existing diseases and may need to be hospitalised. The surgery involves the removal of the opaque lens of the eye and its replacement with an artificial lens. Cataract surgery is one of the top ten surgeries, in terms of volume, performed in public hospitals in Singapore.

II CATARACT SURGERY

2. There are two main types of cataract surgery

- **Phacoemulsification (PE)**. Phacoemulsification, or ultrasonic cataract removal is a procedure where the cataract in the eye is broken into small pieces by sound vibrations and removed. It is then replaced with an artificial lens called the intraocular lens (IOL). This is the more popularly done technique. A very small cut of about 3 mm is made on the cornea and a small ultrasound probe is inserted into the lens. The lens is broken down into small pieces by sound vibrations and are then sucked out of the capsule of the lens. A foldable IOL is implanted in the capsule. The procedure takes about 20-30 minutes. The small cut does not need stitches and will heal by itself.

- **Extracapsular cataract extraction (ECCE)**. In this procedure, an 8 mm cut is made in the cornea and the opaque lens is removed, leaving behind the capsule. An IOL is then used to replace the lens that was removed and the cut is sewn up. The healing time for this surgery is longer compared to phacoemulsification. Currently, ECCE is done when the cataract is unsuitable for phacoemulsification, eg. hard cataract.

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1 Dr Ganga Ganesan is a Clinical Quality Officer with the Clinical Quality Division, MOH.
2 Another type of cataract surgery is Intracapsular cataract extraction (ICCE), where the whole lens is removed intact with the capsule. Corrective glasses or soft contact lens have to be used after surgery. This procedure is associated with higher risk of complications and is not widely practiced now.
Benefits of Surgery
3 After the surgery, most patients have better eyesight as the opaque lens which distorts and blocks light entering the eye is removed. However, some patients may still need to wear corrective glasses after surgery to have the best possible vision.

Complications
4. Complications that could lead to blindness during surgery (severe bleeding) and after surgery (retinal detachment, internal eye infection-endophthalmitis) are fortunately, rare³.

5. Other complications during surgery include injury to the iris, capsule rupture and vitreous loss, incomplete removal of cataract, loss of nuclear material into vitreous, loss of IOL into vitreous, and abnormal wound closure.

6. Some conditions that may occur after surgery include, cystoid macular oedema, posterior capsule opacification, persistent inflammation, raised intra-ocular pressure, IOL dislocation and corneal decompensation.

III VOLUME
7. The number of cataract surgeries in Singapore has gone up from 10,346 in 1995 to 23,259 in 2004⁴ (Fig.1). The dip in 2003 is probably due to SARS, when most cataract procedures which were not urgently needed were postponed. Cataract surgery in the public restructured hospitals and specialty centres accounted for 85% of all the cataract surgeries done in Singapore in 2004.

Fig 1: Cataract Surgery in Singapore, 1995 – 2004


⁴ Source: Central Claims Processing System, Ministry of Health.
8. The Ministry of Health (MOH) invited public and private hospitals that have centres providing cataract surgery to take part in a study on outcomes of cataract surgery. The following centres agreed to participate:

1. The Singapore National Eye Centre (SNEC),
2. The Eye Institute (TEI), and

9. SNEC staff perform surgeries in SNEC, Changi General Hospital and Mt Alvernia Hospital, while TEI operates in Tan Tock Seng Hospital, National University Hospital and Alexandra Hospital.

10. The annual volume of cataract surgery performed in 2004 at SNEC, Changi General Hospital, Tan Tock Seng Hospital and Jerry Tan Eye Surgery is shown in Table 1.

### Table 1: Volume of Cataract Surgery in 2004 by the participating Centres

<table>
<thead>
<tr>
<th>Institution</th>
<th>Volume</th>
<th>No. of Doctors</th>
<th>Number of surgeries per doctor (50&lt;sup&gt;th&lt;/sup&gt; percentile)</th>
<th>Number of surgeries per doctor (75&lt;sup&gt;th&lt;/sup&gt; percentile)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SNEC</td>
<td>10,013</td>
<td>68</td>
<td>99</td>
<td>240</td>
</tr>
<tr>
<td>SNEC (Changi)</td>
<td>1519</td>
<td>15</td>
<td>43</td>
<td>212</td>
</tr>
<tr>
<td>TEI (TTSH)</td>
<td>4575</td>
<td>29</td>
<td>114</td>
<td>247</td>
</tr>
<tr>
<td>JTES</td>
<td>203</td>
<td>1</td>
<td>NA – as this is a solo practice</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>16310</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Not all of the Doctors work full time. The no of FTE (Full time equivalent) at SNEC is 52.8, SNEC(Changi) is 8 and TEI(TTSH) is 22. Phacoemulsification is the most common procedure in the participating centres (85% at SNEC, 87% at TEI and 99% at JTES).

### IV COSTS

11. The table below shows the total cost of cataract surgery for private patients in the participating centres.

### Table 2: Average Fee for Cataract Surgery

<table>
<thead>
<tr>
<th>Institution</th>
<th>Bill Size (per eye) for PE</th>
<th>Bill Size (per eye) for ECCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SNEC</td>
<td>$2500 - $2900</td>
<td>$2300 - $2700</td>
</tr>
<tr>
<td>SNEC(Changi)</td>
<td>$2905</td>
<td>$2582</td>
</tr>
<tr>
<td>TEI</td>
<td>$2660 - $2850</td>
<td>$2300 - $2800</td>
</tr>
<tr>
<td>JTES</td>
<td>$4,400 - $4,600</td>
<td>$4200 - $4400</td>
</tr>
</tbody>
</table>

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5 Private hospitals providing cataract surgery include Eastshore Hospital, Gleneagles Hospital, Mt Elizabeth Hospital and Raffles Hospital.
V OUTCOMES

12. In this study of outcomes at the four centres, we looked at both success and safety of the procedure.

Success

13. Success in this study is defined as, the percentage of operated eyes without comorbidity (without other diseases or conditions) that achieved a Best Corrected Visual Acuity (BCVA) of 6/12 or better within the third month after the operation. The success rates for PE (>96%) were higher than ECCE (>86%). This is consistent with trends elsewhere and may likely be due to patient factors (as ECCE is used for patients who are not suitable for PE). The rates of these four centres are comparable or better than their overseas counterparts. One study in UK reported BCVA (of 6/9 or better) at 3 months after PE and ECCE of 93% and 80% respectively.

14. The overall success rate (PE + ECCE) in the four centres is above 95%. Centres in the UK and US reported 92% and 93%, respectively.

Safety

15. In this study, safety is defined as the percentage of cataract surgeries that were uneventful. Surgeries complicated by endophthalmitis (infection in the eye) and posterior capsule rupture (a condition where the lens does not remain in place and falls inside the eye) were considered eventful. Intumescent (enlarged or swollen) and postmature cataracts (old and very hard cataracts) were excluded from the study. Over 97% of all cataract surgeries in the participating centres were uneventful. This is comparable with UK’s rate of 96%.

Table 3: Outcomes of cataract surgery

<table>
<thead>
<tr>
<th>Institution</th>
<th>PE Success Rate</th>
<th>PE Safety Rate</th>
<th>ECCE Success Rate</th>
<th>ECCE Safety Rate</th>
<th>Overall Success Rate</th>
<th>Overall Safety Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>SNEC</td>
<td>99.08</td>
<td>98.07</td>
<td>86.67</td>
<td>95.62</td>
<td>98.53</td>
<td>97.92</td>
</tr>
<tr>
<td>SNEC(Changi)</td>
<td>96.19</td>
<td>98.77</td>
<td>87.5</td>
<td>90.00</td>
<td>95.98</td>
<td>98.54</td>
</tr>
<tr>
<td>TEI (TTSH)</td>
<td>98.96</td>
<td>NA*</td>
<td>92.86</td>
<td>NA*</td>
<td>98.47</td>
<td>99.49</td>
</tr>
<tr>
<td>JTES</td>
<td>99.47</td>
<td>100</td>
<td>insufficient number to statistically analyse and report outcomes</td>
<td>NA*</td>
<td>99.47</td>
<td>100.00</td>
</tr>
</tbody>
</table>

* Safety data by type of procedure are not available at the time of publishing.

6 The outcomes from the public institutions are based on operations carried out by Consultants and Senior Consultants. The participating centres followed up on more than 95% of their patients after their operations to monitor their outcomes. The outcomes figures for the public institutions SNEC and TEI are based on a sample of their patients as it would be very resource intensive to review all their cases, in view of the high volume. The sampling methodology was audited by MOH.

7 There are other measures of success as well, for eg. BCVA of 6/6 or 6/9 vision at 6 wks, 1 mth, 3 mths or 6 mths post-op.


VI CONCLUSION

16. For patients whose eyesight is affected by cataracts, cataract surgery improves vision and quality of life. Of the two types of surgery, phacoemulsification was more commonly carried out. Cost varies among the centres. The success and safety of the procedures were generally excellent across all four centres and comparable to international standards.

17. Patients are advised to discuss with their ophthalmologist to find out more about the procedure, potential risks and outcomes before undergoing surgery.