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*“Life is thickly sown with thorns...the longer we dwell on our misfortunes, the greater is their power to harm us.”*

Voltaire (1694 – 1778)  
French writer

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## Mentorship in Academic Medicine: A Catalyst of Talents

Victor J Dzau,<sup>1-3</sup>MD, Khee Chee Soo,<sup>3-5</sup>MBBS, MD, FRACS

The field of medicine is complex. Its interwoven structure of clinical practice, medical education and biomedical research, coupled with intricacies of the health system, makes it challenging for one to navigate through without any help. In any academic medical centre (AMC) or hospital, there is an imperative for senior, more experienced members of the profession to provide guidance to their juniors. There is a need for mentorship, and good mentors are critical to support the enduring success of physicians, scientists and researchers.

### Why Does Mentorship Matter?

Scientific evidence proves that mentoring matters. A meta-analysis conducted by Allen et al on 40 empirical studies<sup>1</sup> found greater objective and subjective career outcomes for those mentored, as compared to those who were not. Objective outcomes refer to tangible career measurements such as annual compensation, salary growth and self-promotion, while subjective outcomes refer to intangibles including career satisfaction and commitment, advancement expectations, as well as intention to stay in one's organisation. The research showed a clear relationship between career-related mentoring and positive career outcomes.

Other studies also suggest a positive correlation between mentoring and one's work environment. A study by Van der Weijden found that young professors who received mentorship had a more positive view of their work environment.<sup>2</sup> Another research on work-life balance in academic medicine found that physician-researchers with mentors felt that they had improved work-life balance.<sup>3</sup>

A mentor is not merely an educator who teaches medical knowledge and clinical techniques. A mentor is a role model who exemplifies medical professionalism, who befriends, advises, and inspires mentees, and imparts values that one simply cannot learn through books or the internet. Being a

mentor is about having a personal relationship with a mentee, and about being willing to take a bet on someone. Through a high degree of trust, mutual respect and commitment, the impartation of wisdom, values and lifelong learning is made possible.

### What's In It for Mentors?

Mentees are not the only ones who benefit from mentor-mentee relationships. Mentorship benefits mentors in many ways. One of the greatest values is in the opportunity to give back. Every experienced or successful doctor would have received help in one way or another in the course of his career, and mentorship provides the chance to give back to the organisation. It is also about contributing to the future, as mentees and newer members of the profession make up the continuum of the health system and ought to be invested in.

Other tangible benefits include attracting talent, since mentors with a good reputation naturally attract many students to work with them. The mentor-mentee relationship also allows mentors to develop their professional network and extend the influence and contribution of their science. Most importantly, mentors too, can learn from their mentees.

### What Mentors Should Teach – The Science and Beyond

Aspiring clinicians and researchers have to master various essential skills—both practical ones, as well as soft skills, of which many cannot be taught in class. Practical skills include responsibility and ethics, scientific investigation, as well as grant and funding navigation. But beyond the science, there are a few things in particular that mentors can impart.

First, they can help mentees navigate the health system and politics. The health system today is highly complex and ever evolving. From understanding the complexities

<sup>1</sup>Institute of Medicine, National Academy of Sciences, USA

<sup>2</sup>Duke University, USA

<sup>3</sup>SingHealth, Singapore

<sup>4</sup>Clinical, Academic & Faculty Affairs, Duke-NUS Graduate Medical School, Singapore

<sup>5</sup>National Cancer Centre Singapore, Singapore

Address for Correspondence: Prof Soo Khee Chee, Director's Office, National Cancer Centre Singapore, 11 Hospital Drive, Singapore 169610.

Email: soo.khee.chee@singhealth.com.sg

of the organisation and its processes, to figuring out how policies translate into practice and how multidisciplinary teams work, there is a myriad of knowledge for new or younger staff to pick up on. More often than not, being able to ask a senior “how do I do this” would put difficult things into perspective. Otherwise, young clinicians may feel perplexed or dejected after futile efforts and setbacks.

Next, mentors can provide guidance to mentees on matters relating to career planning and making career decisions for their future. Having gone ahead, mentors’ experience, insight and wisdom are invaluable. They can identify what mentees love to do, point out their strengths and weaknesses, give frank feedback and inspire them to move in a certain direction. In this way, mentees are also led to discover new things about themselves and develop skills they may not know they possess. Khalil Gibran, *The Prophet*, once said, “If [the teacher] is indeed wise he does not bid you enter the house of his wisdom, but rather leads you to the threshold of your own mind.”

Lastly, mentors can role-model and offer practice advice on organisational planning and management skills, which many clinicians and scientists are less in tuned to. Time management, communication and leadership, as well as the wisdom behind running a laboratory and taking charge of people are among some of the important skills required for the running of a successful healthcare organisation or AMC.

### What Makes a Good Mentor?

Every good mentor should uphold a few universal values. First, primacy of patient welfare—the deep conviction to help patients is what sustains mentors’ lifelong commitment towards nurturing the next generation, and compels them to do what they do. Mentors with this conviction also pass on the value of prioritising patients to their mentees.

Intellectual nimbleness without arrogance is vital. On one hand, physicians need to exercise intellectual nimbleness and critical thinking when treating patients or doing research. Yet, should arrogance set in, it can lead to complacency and lead one away from the sense of empathy that is crucial in interpersonal relationships. Only without arrogance can one truly benefit from lifelong learning and consistently make progress.

Mentors must have a spirit of generosity. Good mentors want their mentees to succeed. They selflessly make connections and offer resources to their mentees; they believe in their mentees and relentlessly support their endeavours. Most importantly, they keep their protégés’ best interests at heart.

Prof Dzau experienced this spirit of generosity with his mentor, Dr Eugene Braunwald. Prof Dzau was working at the Massachusetts General Hospital (MGH) as a cardiology

fellow when Dr Braunwald asked him to take up the post of chief medical resident at Brigham and Women’s Hospital. It was a great opportunity for Prof Dzau, but he did not want to give up on his research at MGH. His mentor understood the importance of his research to him, and decided to pay for a technician to keep his laboratory running. It was significant because Dr Braunwald was essentially giving money to MGH, one of Brigham and Women’s biggest competitors—but out of a spirit of generosity towards his mentee.

Good mentors also believe in meritocracy and take bets on people. They look beyond visible or quantifiable measures like family background and academic results to spot the passion, potential and desirable traits in mentees.

Michael Faraday, one of the greatest scientists of the 19<sup>th</sup> century, is a good example. Faraday’s discoveries of electrolysis and benzene built the foundation of science, but few people know that he came from a poor family and had little formal education. At the age of 20, Faraday attended a lecture by the chemist Humphry Davy. Faraday wanted to study with Davy and sent him 300-page notes based on his lecture. Davy took a bet on him, first hiring him as his secretary, and then as his assistant. In 1800s, this was a big bet as the English society then was especially classist, where the elite looked down on the uneducated poor. However, it was only with this “bet” that Faraday rose to greatness and made significant contributions to science.

### Fostering an Ecosystem for Mentorship

Recognising the value of mentorship, many AMCs and institutions have put in place mentorship initiatives, established the concept of mentoring teams, and developed mentoring programmes for their staff.

At the SingHealth Duke-NUS AMC, for example, the Academic Medicine Research Institute recently launched an Individual Development Plan (IDP) programme for clinician scientists and researchers. The IDP is a mentorship programme that looks at developing individualised plans for individuals upon assessment of their career goals, research strengths and scientific needs. The institute then links them up with mentors, as well as a range of support programmes and experts to support them on their research journey.

The value of mentoring and being involved in mentoring relationships is undeniable. It is time to invest in such relationships and bring individuals, institutions, and ultimately medicine, to greater heights.

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## Neonatal Outcome of the Late Preterm Infant (34 to 36 Weeks): The Singapore Story

Nirmal Kavalloor Visruthan, <sup>1</sup>MBBS, DCH, MRCPCH (UK), Pratibha Agarwal, <sup>1</sup>MBBS, MD (Paeds), DNB (Paeds), Bhavani Sriram, <sup>1</sup>MBBS, MRCP (Paeds), Victor Samuel Rajadurai, <sup>1</sup>MBBS, MD (Paeds), MRCP

### Abstract

**Introduction:** Late preterm (LP) neonates (34 to 36 weeks gestation) are often managed like term neonates though current literature has identified them to have greater complications. The primary objective of our study was to evaluate and compare morbidity and resource utilisation in LPs especially in view of paucity of Asian studies in this regard. **Materials and Methods:** A retrospective audit was carried out on 12,459 neonates born in KK Women's and Children's Hospital (KKWCH). The chief outcome measures were hypoglycaemia, hypothermia, respiratory morbidity, feeding problems and neonatal jaundice. Resource utilisation included neonatal intensive care unit (NICU) admission, mechanical ventilation, parenteral nutrition and length of hospitalisation. **Results:** Of 12,459 deliveries, 1221 (10%) were LP deliveries with a significantly increasing trend of 8.6% to 10% from 2002 to 2008 ( $P = 0.001$ ). Neonatal morbidity in the form of hypoglycaemia (34 weeks vs 35 to 36 weeks vs term: 26% vs 16% vs 1%); hypothermia (5% vs 1.7% vs 0.2%); feeding difficulties (30% vs 9% vs 1.4%); respiratory distress syndrome (RDS) (4% vs 1% vs 0.1%); transient tachypnea of the newborn (TTNB) (23% vs 8% vs 3%) and neonatal jaundice (NNJ) needing phototherapy (63% vs 24% vs 8%), were significantly different between the 3 groups, with highest incidence in 34-week-old infants. Resource utilisation including intermittent positive pressure ventilation (IPPV) (15% vs 3.5% vs 1%), total parenteral nutrition/intravenous (TPN/IV) (53% vs 17% vs 3%) and length of stay ( $14 \pm 22$  days vs  $4 \pm 4.7$  days vs  $2.6 \pm 3.9$  days) was also significantly higher ( $P < 0.001$ ) in LPs. **Conclusion:** LP neonates had significantly higher morbidity and resource utilisation compared to term infants. Among the LP group, 34-week-old infants had greater complications compared to infants born at 35 to 36 weeks.

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**Key words:** Morbidity, Mortality, Respiratory distress syndrome, Total parenteral nutrition

<sup>1</sup>Department of Neonatology, KK Women's & Children's Hospital, Singapore

Address for Correspondence: Dr Nirmal Kavalloor Visruthan, Department of Neonatology, KK Women's and Children's Hospital, 100 Bukit Timah Road, Singapore 229899.

Email: nirmal.kavalloor.visruthan@kkh.com.sg

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### Introduction

Neonatologists were caught looking the other way in the early part of the millennium. While they were keenly following the progress of extreme preterms and their travails, preterms born at the other end of the spectrum were being quietly ignored as “well babies”. In July 2005, the National Institute of Child Health and Human Development (NICHD) held a workshop to optimise the care and outcome of the near term pregnancy and near term newborn infant. During this session, varying terms like “near term” and “borderline term” were brought together under the umbrella phrase “late preterm (LP) babies”.<sup>1</sup> They were defined as infants born between weeks 34<sup>+</sup> to 36 and 6/7 completed weeks. This term was used to signify that this age group of preterm infants was “at risk” compared to a term population.<sup>2</sup>

They were also the fastest growing segment of the newborn population.<sup>3,4</sup> In the United States, LP birth rate rose 20% from 1990 to 2006.<sup>5</sup> This increase in LP deliveries is due to various factors including increasing multiple pregnancies, in-vitro fertilisation and delayed childbirth.<sup>6</sup> Other important factors include a combination of obstetric practices<sup>7</sup> and increase in complications of pregnancy.<sup>8,9</sup> Although most inductions and cesarean sections occur for valid obstetric indications, some are electively performed in the absence of any specified medical or obstetric indication.<sup>10</sup> There has been an increase in deliveries with no recorded indication and those done “at maternal request”.<sup>10</sup> There has also been several research articles published on higher morbidities associated with LP neonates<sup>11</sup> including respiratory distress, hypoglycaemia, feeding difficulties and hyperbilirubinemia.

<sup>1</sup>Department of Neonatology, KK Women's & Children's Hospital, Singapore

Address for Correspondence: Dr Nirmal Kavalloor Visruthan, Department of Neonatology, KK Women's and Children's Hospital, 100 Bukit Timah Road, Singapore 229899.

Email: nirmal.kavalloor.visruthan@kkh.com.sg

Also of great concern is the increased risk of mortality, higher length of stay, increased cost and resource utilisation. While these “transitional” issues have been known for some time, recent studies have shown that LP infants compared with term infants face a greater risk for developmental delay and school-related problems up through the first 5 years of life.<sup>12,13</sup>

Current worldwide hospital statistics indicate LPs consist almost 8% to 9% of all live born infants.<sup>6</sup> In the absence of local data, the aims of this study were to assess the incidence of LP deliveries and to evaluate and compare their neonatal morbidity and mortality against term infants. Furthermore, we hypothesised that babies born at 34 weeks had morbidity characteristics separate from the 35- to 36-week infant. Thus, the study also aimed to further subanalyse the morbidity characteristics of the neonate born at 34 weeks in comparison to infant at 35 to 36 weeks rather than club them together as one large “LP” group. In view of the substantially higher costs involved in managing LPs, hospital resource utilisation by LP infants was also analysed in comparison to term infants.

## Materials and Methods

This was a retrospective audit of an annual cohort of all babies born at gestational age between 34<sup>+0</sup> to 36<sup>+6</sup> weeks in KK Women’s and Children’s hospital (KKWCH), Singapore, from 1 January 2008 to 31 December 2008. KKWCH is the largest referral tertiary perinatal centre specialising in women and children’s healthcare in Singapore,<sup>14,15</sup> with a delivery rate of 12,000 per year.

In our institution, babies born at 34 weeks are routinely admitted to the level 2 Special Care nursery. Infants who have completed 35 weeks and birth weight >2000 g without any other significant neonatal concerns are managed in the peripheral Well Baby nursery and are usually discharged after a 24-hour stay in the hospital. Indications for admission to the intensive care unit (ICU) included the need for respiratory support and requirement of central venous access for severe hypoglycaemia or severe growth restriction. At discharge, a referral is made to the local maternal and child health clinics, with no routine follow-up at KKWCH unless clinically indicated.

Gestational age was based on the best obstetrical assessment<sup>16</sup> using information on ultrasound measures and the date of the last menstrual period (LMP). Infants were followed until death or discharge to home from the hospital. The data was collected from a retrospective analysis of the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9 CM) codes available from our hospital information database system. The data for major congenital malformations are based on a birth defect

database maintained by our maternal-fetal department. Major congenital malformations (including neurological/cardiac/renal and gastrointestinal anomalies) confirmed by postnatal clinical/imaging examinations were included.

Hypoglycaemia was defined as plasma glucose levels  $\leq 2.5$  mmol/L.<sup>17,18</sup> Respiratory distress syndrome (RDS) was defined based on clinical signs like retractions, cyanosis, grunting, nasal flaring, tachypnea persisting more than an hour after delivery with x-ray changes.<sup>19</sup> Transient tachypnea of newborn was defined as tachypnea or respiratory distress that improved within 24 to 48 hours.<sup>20</sup> Hypothermia was defined as axillary body temperature less than 36.5°C. Feeding problems were defined as poor suck, abdominal distention or recurrent vomiting. Neonatal jaundice was defined as any baby needing phototherapy based on the KKWCH clinical pathway guidelines. Our hospital phototherapy guidelines are described in Appendix 1 (stratifies term and LP babies into different risk groups with different levels of phototherapy).

Maternal demographic data collected included mode of delivery, plurality and presence of maternal complications such as pregnancy induced hypertension (PIH), premature rupture of membranes (PROM), antepartum hemorrhage (APH), gestational diabetes mellitus (GDM) and chorioamnionitis. Neonatal demographic data collected included birth weight, race (self-reported), gender, gestation, APGAR scores and other neonatal morbidities including hypoglycaemia, hypothermia, feeding problems, neonatal jaundice and respiratory distress due to transient tachypnea of the newborn (TTNB) and RDS.

Coders who had at least 3 years’ experience with neonatology cases provided the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9CM) diagnoses. The codes were given using physician assigned diagnoses after perusal of case notes. The analysis was done using SPSS version 16. Categorical data was processed using chi-square test and for continuous data, the student t-test was used.

## Participants

Infants born at 34 weeks were classified as Group 1, while those born at 35 to 36 weeks were classified as Group 2 and the “term controls” belonged to Group 3.

## Results

Out of 12,459 babies born at KKWCH in 2008, 10% were LP (Fig. 1) and 3.6% were less than 34 weeks gestation. LPs constituted 76.1% (1221/1603) of all preterm deliveries in the hospital. As seen in Figure 2, there was an increase in the incidence of prematurity less than 34 weeks gestation

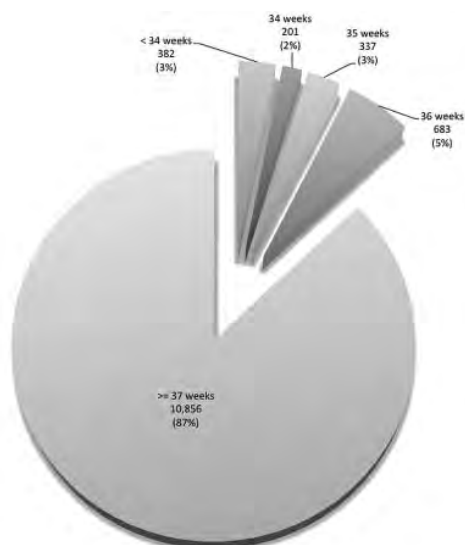


Fig. 1. Distribution of live births in KKWCH according to gestational age at birth.

in this period (2002 to 2008) from 2.4% (360/14971) to 3.6% (458/12535) ( $P < 0.001$ ). There was also a significantly increasing trend in the incidence of LP deliveries from 8.6% to 10% ( $P < 0.003$ ) during this period.

Maternal demographics is presented in Table 1 and with respect to ethnicity, there was a significantly higher representation of the Malays at 35 to 36 weeks compared to the term group ( $P = 0.001$ ). While only 27% of the term babies were delivered by caesarean section, the incidence of lower segment caesarean section (LSCS) increased significantly to 42% at 35 to 36 weeks and 58% at 34 weeks gestation; 28.9% of Group 1 and 15.1% of Group 2 infants were twin deliveries compared to just 0.8% of Group 3 controls. Similarly 7.5% of Group 1 and 3% of Group 2 were triplet deliveries compared to none in the term group. Assisted reproductive mode of conception was significantly higher in both Group 1 and Group 2 compared to controls.

There was significantly higher incidence of major congenital malformations in LPs compared to term infants (1.8% vs 0.6%). The maternal complications, which were associated with LP deliveries included PIH, PROM, chorioamnionitis and GDM. As can be seen from Table 1, all these complications except APH were significantly higher in LP deliveries compared to term infants. Though the incidence of PIH in LPs was significantly higher than term infants, there was no significant difference between Group 1 and Group 2 infants. The incidence of PROM, however, was significantly higher in Group 1 compared to Group 2 and Group 3.

The mortality rates were low at 0.91 per 1000 (11/12077) in our study and were not significantly different between the 3 groups. Both subgroups of LPs had significantly higher incidence of 1-minute APGAR scores  $< 7$  compared

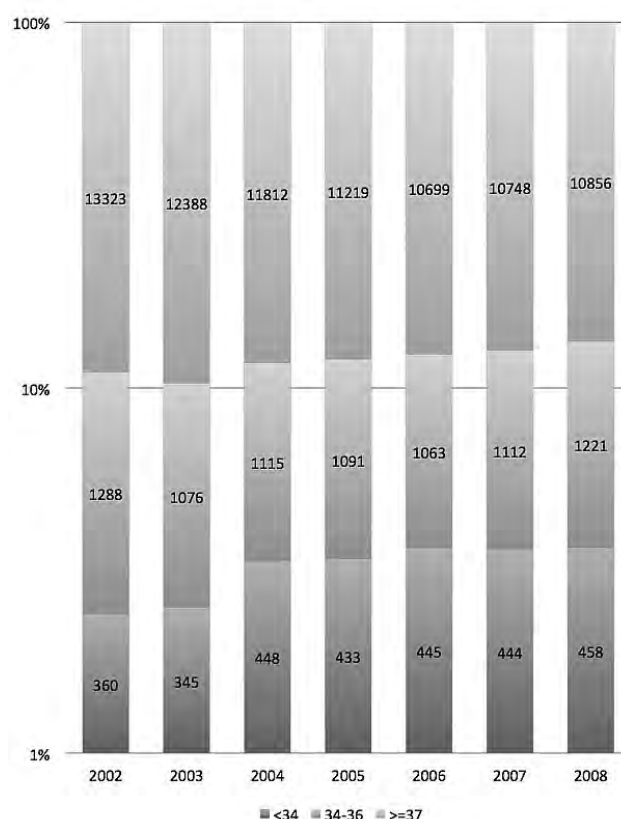


Fig. 2. Increase of late preterms versus preterm babies less than 34 weeks and term infants from 2002 to 2008 born in KKWCH.

to term infants (8.5% and 2.9% vs 1.2%) ( $P \leq 0.001$ ) while the 5-minute APGAR scores were comparable.

As seen in Table 2, the incidence of neonatal complications such as hypoglycaemia, hypothermia, feeding problems and neonatal jaundice were significantly higher in LP deliveries compared to term infants and within the LP group, the complications were higher in Group 1 compared to Group 2. Respiratory complications are an important cause of morbidity in the LP group and therefore were looked at separately. The rates of TTNB, RDS as well as the need for assisted ventilation were significantly higher in LPs compared to term infants ( $P < 0.001$ ) (Table 3).

LP infants also had other high neonatal resource utilisation in the form of antibiotics therapy, parenteral nutrition and blood transfusions (Table 3), which were again higher with decreasing gestational age groups. Only 65% of infants at 35 to 36 weeks could be managed in the Well Baby nursery compared to 90% of term infants ( $P < 0.001$ ). Seventy-two percent of Group 1, 29% of Group 2 and 9% of term infants needed admission to the Special Care nursery ( $P < 0.001$ ). Three babies who were in the 34-week gestation group were admitted into the peripheral nursery (level 1 care) even though our departmental guidelines require them to

Table 1. Maternal Characteristics and Demographics Data

|                               | Group 1 (34 Weeks)<br>n = 201, n (%) | Group 2 (35–36 Weeks)<br>n = 1020, n (%) | Group 3 (Term)<br>n = 10,856, n (%) | Group 1 vs Group 2<br>Odds Ratio (95% CI) | Group 2 vs Group 3<br>Odds Ratio (95% CI) |
|-------------------------------|--------------------------------------|------------------------------------------|-------------------------------------|-------------------------------------------|-------------------------------------------|
| <b>Race</b>                   |                                      |                                          |                                     |                                           |                                           |
| Chinese                       | 83 (41.2)                            | 450 (44.1)                               | 5094 (46.9)                         | 0.89 (0.65 – 1.22)                        | 0.89 (0.78 – 1.02)                        |
| Malay                         | 75 (37.3)                            | 342 (33.5)                               | 3020 (27.8)                         | 0.18 (0.05 – 1.63)                        | 1.30 (1.13 – 1.50)*                       |
| Indian                        | 28 (13.9)                            | 121 (11.8)                               | 1293 (11.9)                         | 1.20 (0.75 – 1.91)                        | 0.99 (0.81 – 1.22)                        |
| Others                        | 15 (7.5)                             | 107 (10.4)                               | 1449 (13.3)                         | 0.69 (0.38 – 1.24)                        | 0.76 (0.61 – 0.94)*                       |
| <b>Age</b>                    |                                      |                                          |                                     |                                           |                                           |
| Average years (SD)            | 29.15                                | 29.37                                    | 29.53                               |                                           |                                           |
| Median years                  | 30                                   | 30                                       | 30                                  |                                           |                                           |
| <b>Type of delivery</b>       |                                      |                                          |                                     |                                           |                                           |
| NVD                           | 82 (40.8)                            | 563 (47.8)                               | 7248 (67)                           | 0.55 (0.40 – 0.76) <sup>†</sup>           | 0.61 (0.54 – 0.70) <sup>†</sup>           |
| Instrumental                  | 3 (1.5)                              | 24 (3.3)                                 | 630 (5.8)                           | 0.63 (0.10 – 2.21)                        | 0.39 (0.25 – 0.60) <sup>†</sup>           |
| Caesarean section             | 116 (57.7)                           | 433 (42.4)                               | 2978 (27.5)                         | 1.85 (1.34 – 2.54) <sup>†</sup>           | 1.95 (1.71 – 2.23) <sup>†</sup>           |
| Emergency                     | 93 (80.2)                            | 346 (81.1)                               | 1878 (63.1)                         | 1.01 (0.59 – 1.75)                        | 2.33 (1.81 – 3.00) <sup>†</sup>           |
| Elective                      | 23 (19.8)                            | 87 (18.9)                                | 1101 (36.9)                         | 0.98 (0.57 – 1.69)                        | 0.43 (0.33 – 0.55) <sup>†</sup>           |
| IVF                           | 28 (13.9)                            | 64 (6.2)                                 | 191 (1.8)                           | 2.41 (1.46 – 3.97)*                       | 3.13 (2.76 – 5.05)                        |
| <b>Multiple pregnancy</b>     |                                      |                                          |                                     |                                           |                                           |
| Singleton                     | 128 (63.7)                           | 863 (84.6)                               | 10761 (99.2)                        | 0.32 (0.22 – 0.45) <sup>†</sup>           | 0.05 (0.03 – 0.06) <sup>†</sup>           |
| Twins                         | 58 (28.9)                            | 154 (15.1)                               | 95 (0.8)                            | 2.28 (1.58 – 3.28) <sup>†</sup>           | 20.14 (15.3 – 26.48) <sup>†</sup>         |
| Triplets                      | 15 (7.4)                             | 3 (0.3)                                  | 0                                   | 27.33 (7.35 – 65.76)*                     | NA <sup>†</sup>                           |
| Major congenital malformation | 4 (2.0)                              | 18 (1.8)                                 | 63 (0.6)                            | 1.13 (0.037 – 3.59)                       | 3.07 (1.75 – 5.35) <sup>†</sup>           |
| <b>Maternal complications</b> |                                      |                                          |                                     |                                           |                                           |
| PIH/HT                        | 29 (14.0)                            | 137 (13.0)                               | 766 (7.0)                           | 1.09 (0.69 – 1.71)                        | 1.9 (1.56 – 2.31) <sup>†</sup>            |
| PROM                          | 61 (30.0)                            | 104 (10.0)                               | 27 (0.3)                            | 3.83 (2.62 – 5.60) <sup>†</sup>           | 45.53 (29.13 – 71.60) <sup>†</sup>        |
| Chorioamnionitis              | 3 (1.5)                              | 7 (0.7)                                  | 2 (<0.1)                            | 2.19 (0.26 – 9.48)                        | 37.50 (7.18 – 106.34) <sup>†</sup>        |
| APH/abruption                 | 7 (3.5)                              | 18 (1.8)                                 | 125 (1.1)                           | 2.00 (0.75 – 5.18)                        | 1.53 (0.902 – 2.57)                       |
| GDM                           | 22 (11.0)                            | 123 (12.3)                               | 150 (1.4)                           | 0.89 (0.53 – 1.48)                        | 9.78 (7.58 – 12.63) <sup>†</sup>          |

APH: Antepartum haemorrhage; GDM: Gestational diabetes mellitus; HT: Hypertension; IVF: In-vitro fertilisation; NA: Not available; NVD: Normal vaginal delivery; PIH: Pregnancy induced hypertension; PROM: Premature rupture of membranes

\* $P < 0.05$

<sup>†</sup> $P < 0.001$

be in Special Care nursery. A significantly higher number of LP infants needed admission to the neonatal intensive care unit (NICU) compared to term infants (Group 1: 26% vs Group 2: 6.4% vs Group 3: 1%,  $P < 0.001$ ). The mean length of stay was significantly higher in both Group 1 and Group 2 of LP infants (14 days and 4 days respectively) compared to the term group (2.6 days).

## Discussion

A significantly increasing trend in the incidence of LP births was seen in our study over the last 7 years with LP births comprising 10% of all births in 2008. This increasing trend has also been reported by Tomashek and other authors.<sup>2,11</sup> However, in the United States, following a

long period of steady increase, the first signs of a declining trend in the last 3 decades have been noted with LP birth rate decreasing from 12.8% in 2006 to 12.3% in 2008.<sup>5</sup> At the time of writing this article, we are seeing an increase in general awareness about LP infants.<sup>21,22</sup> LPs have been featured in the mainstream media and their health risks are being heavily debated.<sup>23–25</sup> Unfortunately, studies have shown that 51.7% of parents are unaware of the risks involved with LP delivery.<sup>26</sup> Thus it is the responsibility of obstetricians, perinatologists and neonatologists at an individual level and as professional societies to educate the medical community and the general public on this subject.

The higher incidence of LP infants in the Malay ethnic group could be postulated to the higher incidence of hypertension reported during pregnancy in this ethnic

Table 2. Neonatal Demographics and Morbidity: Comparison of Late Preterm and Term Cohort

|                                           | Group 1 (34 Weeks)<br>n = 201, n (%) | Group 2 (35–36 Weeks)<br>n = 1020, n (%) | Group 3 (Term)<br>n = 10,856, n (%) | Group 1 vs Group 2<br>Odds Ratio (95% CI) | Group 2 vs Group 3<br>Odds Ratio (95% CI) |
|-------------------------------------------|--------------------------------------|------------------------------------------|-------------------------------------|-------------------------------------------|-------------------------------------------|
| <b>Weight</b>                             |                                      |                                          |                                     |                                           |                                           |
| Mean birth weight                         | 2152 ± 453                           | 2579 ± 412                               | 3137 ± 397                          | NA <sup>†</sup>                           | NA <sup>†</sup>                           |
| <1.5 kg                                   | 10 (5.0)                             | 2 (<0.5)                                 | 0                                   | 26.65 (5.44 – 79.50) <sup>†</sup>         | NA                                        |
| 1.5 – 2 kg                                | 69 (34.0)                            | 72 (7.0)                                 | 25 (<0.5)                           | 6.88 (4.64 – 10.21) <sup>†</sup>          | 32.90 (20.35 – 53.53) <sup>†</sup>        |
| 2 – 2.5 kg                                | 88 (44.0)                            | 380 (37.0)                               | 495 (4.5)                           | 1.31 (0.95 – 1.80)                        | 12.43 (10.60 – 14.57) <sup>†</sup>        |
| >2.5 kg                                   | 34 (17.0)                            | 566 (55.0)                               | 10,336 (95.0)                       | 0.16 (0.11 – 0.24) <sup>†</sup>           | 0.062 (0.05 – 0.07) <sup>†</sup>          |
| <b>Neonatal morbidity</b>                 |                                      |                                          |                                     |                                           |                                           |
| Hypoglycaemia                             | 53 (26.0)                            | 160 (16.0)                               | 114 (1.0)                           | 1.92 (1.32 – 2.79) <sup>†</sup>           | 17.53 (13.55 – 22.69) <sup>†</sup>        |
| Hypothermia                               | 10 (5.0)                             | 17 (1.7)                                 | 23 (0.2)                            | 3.09 (1.29 – 7.25) <sup>*</sup>           | 7.98 (4.07 – 15.6) <sup>†</sup>           |
| Feeding problems                          | 60 (30.0)                            | 92 (9.0)                                 | 152 (1.4)                           | 4.29 (2.91 – 6.32) <sup>†</sup>           | 6.98 (5.30 – 9.20) <sup>†</sup>           |
| NNJ needing phototherapy                  | 133 (63.0)                           | 243 (24.0)                               | 847 (8.0)                           | 6.25 (4.46 – 8.78) <sup>†</sup>           | 3.70 (3.14 – 4.35) <sup>†</sup>           |
| <b>Respiratory morbidity</b>              |                                      |                                          |                                     |                                           |                                           |
| TTNB                                      | 49 (23.0)                            | 78 (8.0)                                 | 294 (3.0)                           | 3.89 (2.57 – 5.89) <sup>†</sup>           | 2.97 (2.28 – 3.88) <sup>†</sup>           |
| RDS                                       | 8 (4.0)                              | 15 (1.4)                                 | 11 (0.1)                            | 2.77 (1.06 – 7.08) <sup>*</sup>           | 7.40 (3.15 – 17.54) <sup>†</sup>          |
| <b>APGAR scores</b>                       |                                      |                                          |                                     |                                           |                                           |
| 1-min APGAR <7                            | 17 (8.5)                             | 30 (2.9)                                 | 137 (1.2)                           | 3.05 (1.57 – 5.87) <sup>†</sup>           | 2.37 (1.56 – 3.59) <sup>†</sup>           |
| 5-min APGAR <7                            | 4 (2.0)                              | 8 (0.8)                                  | 43 (0.4)                            | 2.56 (0.64 – 9.49)                        | 1.99 (0.86 – 4.41)                        |
| Neonatal mortality (per 1000 live births) | 4.97/1000                            | 0.98/1000                                | 0.83/1000                           | NA                                        | NA                                        |

NNJ: Neonatal jaundice; RDS: Respiratory distress syndrome; TTNB: Transient tachypnea of the newborn

<sup>\*</sup>P <0.05<sup>†</sup>P <0.001

Table 3. Neonatal Resource Utilisation

|                              | Group 1 (34 Weeks)<br>n = 201, n (%) | Group 2 (35–36 Weeks)<br>n = 1020, n (%) | Group 3 (Term)<br>n = 10,856, n (%) | Group 1 vs Group 2<br>Odds Ratio (95% CI) | Group 2 vs Group 3<br>Odds Ratio (95% CI) |
|------------------------------|--------------------------------------|------------------------------------------|-------------------------------------|-------------------------------------------|-------------------------------------------|
| CPAP                         | 51 (25.0)                            | 61 (6.0)                                 | 142 (1.3)                           | 5.34 (3.48 – 8.22) <sup>†</sup>           | 4.78 (3.49 – 6.59) <sup>†</sup>           |
| IPPV                         | 39 (15.0)                            | 36 (3.5)                                 | 107 (1.0)                           | 6.58 (3.95 – 10.96) <sup>†</sup>          | 1.86 (1.21 – 2.87) <sup>*</sup>           |
| TPN/IV                       | 107 (53.0)                           | 177 (17.0)                               | 325 (3.0)                           | 5.42 (3.88 – 7.57) <sup>†</sup>           | 6.80 (5.56 – 8.31) <sup>†</sup>           |
| Antibiotics >24 hours        | 69 (34.0)                            | 66 (6.4)                                 | 195 (1.8)                           | 7.56 (5.06 – 11.29) <sup>†</sup>          | 3.78 (2.81 – 5.09) <sup>†</sup>           |
| Blood transfusion            | 14 (7.0)                             | 13 (1.3)                                 | 44 (0.4)                            | 5.80 (2.52 – 13.35) <sup>†</sup>          | 3.17 (1.62 – 6.11) <sup>†</sup>           |
| Exchange transfusion         | 1 (0.5)                              | 1 (0.1)                                  | 8 (<0.1)                            | NA                                        | NA                                        |
| <b>Highest level of stay</b> |                                      |                                          |                                     |                                           |                                           |
| ICU                          | 50 (24.8)                            | 65 (6.3)                                 | 135 (1.2)                           | 4.87 (3.17 – 7.45) <sup>†</sup>           | 5.41 (3.95 – 7.40) <sup>†</sup>           |
| SCN                          | 148 (73.6)                           | 293 (28.7)                               | 947 (8.7)                           | 6.93 (4.86 – 9.90) <sup>†</sup>           | 4.22 (3.61 – 4.92) <sup>†</sup>           |
| Level 1 nursery              | 3 (1.5)                              | 662 (65.0)                               | 9774 (90.0)                         | NA <sup>†</sup>                           | 0.20 (0.17 – 0.24) <sup>†</sup>           |
| <b>Length of stay</b>        |                                      |                                          |                                     |                                           |                                           |
| Mean ± 2 SD days             | 14 ± 22                              | 4 ± 4.7                                  | 2.6 ± 3.9                           | NA <sup>†</sup>                           | NA <sup>†</sup>                           |
| Median                       | 9                                    | 3                                        | 2                                   |                                           |                                           |

CPAP: Continuous positive airway pressure; ICU: Intensive care unit; IPPV: Intermittent positive pressure ventilation; NA: not applicable; SCN: Special care nursery; SD: Standard deviation; TPN/IV: Total parenteral nutrition/intravenous

<sup>\*</sup>P <0.05<sup>†</sup>P <0.001

group.<sup>27</sup> Thus there is a need for closer monitoring and optimising management of this group in the periconceptional period and during pregnancy. When we looked at other maternal risk factors, there was a higher incidence of PROM in the study group, especially at 34 weeks. PROM could have been one of the causative factors for the preterm delivery in Group 1 as delivery is generally recommended in the presence of PROM  $\geq 34$  weeks.<sup>28</sup>

Among the LP group, a significantly higher number were conceived by assisted reproductive technology (ART) compared to term controls. This could possibly explain the higher number of multiple births in our study cohorts as ART is well known to be associated with multiple pregnancies.<sup>29,30</sup>

In our study, 20% of the LP deliveries were due to elective cesarean sections. The indications for these deliveries were not available to us. A recent study similarly showed that 23% of all LP deliveries had no recorded indication.<sup>10</sup> The American College of Obstetrics and Gynecology guidelines state that delivery before 39 weeks should only be undertaken when there is an accepted medical or obstetric complication or if fetal lung maturity has been documented.<sup>31,32</sup>

Our cohort had a similar incidence of RDS and TTNB when compared to other studies of LP infants.<sup>33</sup> The incidence of RDS in our cohort of 34-week infants was 4% and 1.4% at 35 to 36 weeks. The significantly higher odds of respiratory distress in the study cohort and the increasing trend with decreasing gestational age have been well documented. It has been shown that LP infants have reduced expression of epithelial sodium channels, which are essential to clear lung fluid after birth.<sup>34</sup> This possibly explains the significantly higher incidence of TTNB in the LP infant. Cesarean section before the onset of labour has been shown to increase the incidence of respiratory morbidity.<sup>6</sup> Greater than one third of the 34-week gestational age infants and 10% of 35 to 36 week infants needed respiratory support in our cohort. Similar figures of 23% to 33% of LP infants needing respiratory support have been reported in recent literature.<sup>35</sup>

In our study the LP infants were 3 to 6 times more likely to develop significant neonatal jaundice needing phototherapy. Similar figures have been reported widely with odds of 2.5 to 13 times higher risk in LPs compared to term infants. The reasons for this significant hyperbilirubinemia are believed to be due to reduced hepatic uptake, decreased conjugation and increased entero-hepatic circulation.<sup>36</sup> Even though the rates of neonatal jaundice are higher in LPs, rates of requirement of exchange transfusion are not significantly different. Thus, the LP infant needs to be closely monitored using high-risk criteria and aggressively treated for neonatal hyperbilirubinemia.

The 16% incidence of hypoglycaemia seen in our study in babies at 35 to 36 weeks is very similar to the figures quoted by Wang et al for this gestation.<sup>33</sup> The pathogenesis of hypoglycaemia in the LP infant is due to the immaturity of the hepatic enzyme systems resulting in inadequate gluconeogenesis and glycogenolysis as well as decreased glycogen stores. This is further aggravated by the presence of feeding difficulties commonly seen in this cohort of neonates.<sup>37,38</sup>

In our study, the LP infants had a higher incidence of feeding problems which is similar to the results of other studies.<sup>39-41</sup> Some of the reasons postulated for this have been decreased alertness, poor latching-on skills, decreased oromotor tone, disorganised sucking patterns and poor suck swallow coordination.<sup>42</sup> The immature suction pressures produced have been shown to reduce lactogenesis. Thus, there may be difficulty in establishing maternal-infant bonding and successful breastfeeding. Furthermore, feeding issues can lead to decreased caloric intake and dehydration which can further exacerbate other complications like hypoglycaemia, hyperbilirubinemia, respiratory distress and temperature instability.<sup>43</sup> Studies have shown that use of nipple shields and breast pumps to promote lactogenesis may help to reduce feeding issues in LP infants.<sup>44-46</sup> A recent study demonstrated the benefits of cup feeds over bottle feeds in LP infants to accelerate maturation of feeding behaviour.<sup>47</sup> The study also demonstrated that cup-fed babies have higher incidence of successful breastfeeding after discharge. This has been demonstrated in several other studies.<sup>48-50</sup> This was not tested in our cohort and may be a useful practice to implement.

Some of the limitations of our study include the retrospective nature and inability to adjust for confounders. Certain morbidities like hypoglycaemia are not routinely tested in term babies unless they are symptomatic. Also term babies usually develop neonatal jaundice needing phototherapy after discharge. We were unable to analyse morbidities in babies who were readmitted and therefore these rates could be underestimated in our study. Lastly, even though the gestational age of the neonates is mainly done by early dating scans or LMP dates, details of this information are not available. These limitations were unavoidable because of the nature of data collection and we intend to do a prospective study in this regard.

One of the strengths of our study lies in the fact that we have analysed babies born at 34 weeks separately from those delivered at 35 and 36 weeks. The definition of LP is arbitrary and maturation is a continuum. Our study shows that babies born at 34 weeks gestational age behaved significantly different from the 35- and 36-week gestational age newborns and had 3 times higher odds of developing respiratory distress compared to those at 35 to 36 weeks. They also had

4 times higher risk of developing hypothermia and twice the chance of developing hypoglycaemia compared to babies born at 35 and 36 weeks. We therefore believe it would be inappropriate to give recommendations on management of LPs as a whole and separate tailored guidelines for each gestation may be more appropriate. Long-term developmental follow-up of LPs have demonstrated a 36% higher incidence of developmental delay in comparison to term babies.<sup>12</sup> It is not known whether these issues are related to the abovementioned perinatal events, or because of brain maturation differences.<sup>49,50</sup> There is currently active research being done on “encephalopathy of prematurity”.<sup>51,52</sup> An infant born at 34 gestational weeks has only 65% of the total brain weight of a term infant.<sup>53</sup> The further growth of the grey matter areas occur at varying rates and secondary circulatory insufficiency can lead to selected neuronal necrosis in vascular border zones.<sup>54</sup> Therefore the LP infant needs to be followed up longitudinally in a structured manner to monitor for growth and neurodevelopment so as to optimise the interventions and outcomes of a large high-risk vulnerable population.<sup>2</sup> We have now initiated a LP follow-up clinic in our hospital to monitor their neurodevelopment.

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## Appendix 1

High-risk Phototherapy Criteria

| Age in Hours                     | Off Phototherapy/<br>Discharge | Admit for<br>Phototherapy | Start<br>Single Blue<br>Phototherapy | Start<br>Double Blue<br>Phototherapy | Do Double Volume<br>Exchange Transfusion |
|----------------------------------|--------------------------------|---------------------------|--------------------------------------|--------------------------------------|------------------------------------------|
| Day 1<br>(<24 hours)             | 90                             | 130                       | 140                                  | 220                                  | 260                                      |
| Day 2<br>(>24 to 48 hours)       | 160                            | 180                       | 190                                  | 250                                  | 290                                      |
| Day 3<br>(>48 to 72 hours)       | 190                            | 210                       | 220                                  | 280                                  | 320                                      |
| Day 4 to 5<br>(>72 to 120 hours) | 190                            | 220                       | 220                                  | 300                                  | 340                                      |
| >120 hours to day 14             | 220                            | 260                       | 260                                  | 300                                  | 340                                      |

Phototherapy Guidelines for Babies Born with Birth Weight &lt;2 kg or at &lt;5 Weeks PMA

| Birth Weight (g) | Photo Level (mmol/L) |          | Exchange Level (mmol/L) |          |
|------------------|----------------------|----------|-------------------------|----------|
|                  | Normal               | Abnormal | Normal                  | Abnormal |
| <1250            | 150                  | 120      | 220                     | 190      |
| 1250 – 1499      | 170                  | 140      | 250                     | 220      |
| 1500 – 1999      | 200                  | 170      | 310                     | 270      |
| 2000 – 2400      | 220                  | 190      | 340                     | 300      |
| ≥2500            | 260                  | 230      | 400                     | 340      |

PMA: Post menstrual age

Low-risk Phototherapy Criteria

| Age in Hours                     | Off Phototherapy/<br>Discharge | Admit for<br>Phototherapy | Start<br>Single Blue<br>Phototherapy | Start<br>Double Blue<br>Phototherapy | Do Double Volume<br>Exchange Transfusion |
|----------------------------------|--------------------------------|---------------------------|--------------------------------------|--------------------------------------|------------------------------------------|
| Day 2<br>(>24 to 48 hours)       | 190                            | 210                       | 220                                  | 300                                  | 340                                      |
| Day 3<br>(>48 to 72 hours)       | 220                            | 250                       | 260                                  | 320                                  | 360                                      |
| Day 4 to 5<br>(>72 to 120 hours) | 220                            | 260                       | 260                                  | 360                                  | 400                                      |
| >120 hours to day 14             | 260                            | 300                       | 300                                  | 360                                  | 400                                      |

## A Review of Back Injury Cases Notified to the Ministry of Manpower from 2011 to 2012

Shiu Hong Wong, <sup>1</sup>*MBBS, MPH*, Kenneth KY Choy, <sup>2</sup>*MBBS, MMed (Occ Med), FAMS*

### Abstract

**Introduction:** In Singapore, the notification of workplace accidents and occupational diseases is a legal requirement under the Workplace Safety and Health (Incident Reporting) Regulations. This review is to identify back injury cases with physical work stresses and propose recommendations for preventive measures. **Materials and Methods:** Cases involving back injuries notified to the Ministry of Manpower (MOM) from 1 January 2011 to 31 December 2012 were reviewed. Using predefined criteria, cases with physical work stresses were identified and the associated variables analysed. **Results:** A total of 1124 notifications involving back injuries were received from 2011 to 2012; 579 cases (52%) were identified to have physical work stresses, of which 447 cases (77%) were males and 375 (64%) of them were between the ages of 21 to 40 years. The commonest physical work stresses were carrying (35%), awkward postures (22%) and lifting (20%). Majority of the cases came from the following sectors: construction (14%), accommodation and food services (12%), transport and storage (12%), manufacturing (10%) and wholesale and retail trade (10%). **Conclusion:** We identified the main physical work stresses in the back injury cases as carrying, awkward postures and lifting. The common industries involved were construction, accommodation and food services, and transport and storage sectors. This is useful for programmes aimed at reducing physical work stresses which can lead to improved work and health outcomes for our workers.

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**Key words:** Notification, Physical work stresses, Singapore

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<sup>1</sup>Occupational Medicine Unit, Singapore General Hospital, Singapore

<sup>2</sup>Occupational Safety and Health Division, Ministry of Manpower, Singapore

Address for Correspondence: Dr Wong Shiu Hong, Occupational Medicine Unit, Singapore General Hospital, 226 Outram Road, Singapore 169039.

Email: joshuawong99@yahoo.com

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### Introduction

Work-related low back disorders consist of both low back pain (LBP) and low back injuries. They are a significant and increasing problem all over the world. Studies estimate that between 60% and 90% of people will suffer from low back disorders at some point in their life.<sup>1</sup> Among the working population, many of the factors causing LBP can be associated with the workplace. Worldwide, about 37% of LBP can be attributed to occupation.<sup>2</sup> In Singapore, over 80% of the adult population will suffer from back pain at some time or other in their lives.<sup>3</sup> Apart from resulting morbidity, and in some cases, permanent disability, LBP also incurs high societal costs.<sup>4</sup> Estimates of the total societal cost of LBP are in the range of 20 to 50 billion dollars in the United States and proportionately comparable amounts in Sweden and Canada.<sup>5,6</sup>

Low back disorders include spinal disc problems such as hernias and spondylolisthesis, muscle and soft tissue injuries. On top of the physiological degenerative ageing process, epidemiological studies have shown that physical work stresses in the workplace can result in accelerated degenerative changes in the discs and other structures.<sup>7</sup> The understanding of mechanical factors involved in disc degeneration is important for evaluating LBP aetiologies and implementing preventive measures.

The purpose of this review is to identify cases of LBP with underlying physical work stresses at the workplace. With knowledge of these risk factors, preventive measures can be recommended and implemented to reduce the occurrence of LBP among the working population.

In Singapore, the notification of workplace accidents and occupational diseases is a legal requirement under

<sup>1</sup>Occupational Medicine Unit, Singapore General Hospital, Singapore

<sup>2</sup>Occupational Safety and Health Division, Ministry of Manpower, Singapore

Address for Correspondence: Dr Wong Shiu Hong, Occupational Medicine Unit, Singapore General Hospital, 226 Outram Road, Singapore 169039.

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Table 1. Internal Criteria for Physical Work Stresses

| Inclusion Criteria to Determine if Case has Physical Work Stresses                                                                                                                                                                                                 | Exclusion Criteria                                                                                                                                                                                                                     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. No direct trauma involved                                                                                                                                                                                                                                       | 1. Accident type: <ul style="list-style-type: none"> <li>collapse/failure of structures, exposure to extreme temperatures, fires and explosion, electrical current, falling from height, traffic accidents, slips and trips</li> </ul> |
| 2. Presence of one or more risk factors: <ul style="list-style-type: none"> <li>manual handling</li> <li>lifting of heavy objects</li> <li>frequent bending or twisting (back)</li> <li>prolonged awkward postures (back)</li> <li>whole body vibration</li> </ul> | 2. Nature of injury: <ul style="list-style-type: none"> <li>bites and stings, burns, concussions, crushing, cuts and bruises</li> </ul>                                                                                                |

Table 2. Summary of Epidemiological Evidence with Risk Estimates (Attributable Fraction) of Associations with Work-related Factors Associated with LBDs Resulting in LBP<sup>6</sup>

| Work-related Risk Factor      | Attributable Fraction (%) Range |
|-------------------------------|---------------------------------|
| Manual material handling      | 11 – 66                         |
| Frequent bending and twisting | 19 – 57                         |
| Heavy physical load           | 31 – 58                         |
| Static work posture           | 14 – 32                         |
| Repetitive movements          | 41                              |
| Whole body vibration          | 18 – 80                         |

the Workplace Safety and Health (Incident Reporting) Regulations. All workplaces are covered under these Regulations and employers have to report work-related deaths, injuries, dangerous occurrences and occupational diseases to the Ministry of Manpower (MOM). As such, LBP due to injuries sustained by employees at work would be notified to MOM under the category of ‘Work Accidents’ (Appendix 1).

### Materials and Methods

Cases involving back injuries notified to MOM from 1 January 2011 to 31 December 2012 were reviewed. To determine if a case has any underlying physical work stresses, an internal criteria was developed (Table 1) with reference from National Research Council’s list of work-related factors associated with lower back disorders resulting in LBP (Table 2).<sup>8</sup>

Based on the criteria, all back pain cases were divided into those that were non-traumatic and those that were trauma-related. For the non-traumatic cases, we then attempted to determine the underlying physical work stresses.

Figure 1 summarises the methodology involved. Presence of physical work stress/es is based on the description of the incident or accident, for example: “At about 3pm after

making a few trips of disposing the debris and loading the cement bags (about 5 to 6 bags) each at a time, suddenly I sprained my back when I was about to load heavy materials. I slowly tried to control my back and immediately informed my boss, who then told me to go to XXX Hospital”.

In this case, the physical work stresses was identified

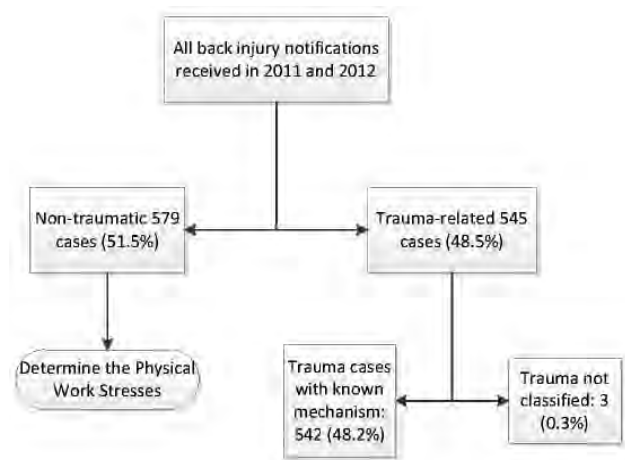


Fig. 1. Flowchart showing the methodology used to determine cases with underlying physical work stresses.

as handling heavy loads. Cases fulfilling the criteria were analysed for demographics and risk factors. Difference in median medical certificate (MC) days between back injuries due to physical work stresses and trauma cases was analysed using STATA data analysis and statistical software version 13 (StataCorp LP, Texas, USA).

## Results

A total of 1124 back injury cases were notified to MOM from 2011 to 2012; 579 cases (52%) were identified to be 'non-trauma' and to have physical work stresses. Of these, 447 cases (77%) were males and 471 (87%) of them were between the ages of 21 to 40 years. The majority of the remaining 545 cases were deemed to have occurred as a result of accidents or of a nature not associated with physical work stresses. Among these, 3 cases did not have sufficient information and could not be classified (Table 3).

Among the cases fulfilling criteria, the commonest physical work stresses were carrying (35%), awkward postures (22%) and lifting (20%). Some cases had more than one physical work stress. For example, some cases had both frequent bending of the back and lifting of heavy loads. We were, however, not able to specify the physical work stresses for some of these cases due to limited information in the description. Given that the notification system allows the user to enter free text for the description of the incident, there were 72 cases (12%) classified as those with physical

work stresses because, firstly the presence of trauma were excluded by the investigating officers who reviewed the cases. Secondly, these cases had very brief descriptions about the incidents, e.g. "hurt his back during work" without giving additional details. Thus, the mechanism was deemed unspecified (Table 4).

Industries with the highest prevalence of back injuries due to physical work stresses were construction (14%), accommodation and food services (12%), transport and storage excluding logistics and transport (12%), manufacturing (10%) and wholesale and retail trade (10%). These categories are classifications of economic activities which have been standardised and published as the Singapore Standard Industrial Classification (SSIC) since 1958. The SSIC is used for censuses of population, household and establishment surveys and increasingly, in administrative databases. The SSIC adopts the basic framework and principles of the International Standard Industrial Classification of All Economic Activities (ISIC) developed by the United Nations Statistics Division. It is reviewed and updated regularly to reflect significant changes in the structure of the Singapore economy and the emergence of new activities as well as to align with changes in the international standard.

Occupations with the highest prevalence are construction workers (16%), airline cabin crew (7%), technician (5%), courier (3%) and cleaner (3%) (Table 5). The prevalence rate was obtained with reference to the 2012 statistics on Singapore's resident labour force published by MOM.<sup>9</sup> The results are tabulated in Table 6.

Comparing Tables 5 and 6, there might be some discrepancies with regards to the high incidence of cases among construction workers in this dataset but the prevalence is actually relatively low among local residents. The report on Labour Force in Singapore, 2012 only covered private households and excluded workers living in construction worksites, dormitories and workers' quarters at

Table 3. Demographics of Cases Fulfilling Inclusion Criteria for Physical Work Stresses

| Variables   | No. of Cases in 2011 | No. of Cases in 2012 |
|-------------|----------------------|----------------------|
| Gender      | 262                  | 317                  |
| Male        | 202 (77%)            | 245 (77%)            |
| Female      | 60 (23%)             | 72 (23%)             |
| Age         |                      |                      |
| ≤20         | 0                    | 3                    |
| 21 – 30     | 94 (36%)             | 104 (33%)            |
| 31 – 40     | 68 (26%)             | 107 (33%)            |
| 41 – 50     | 69 (26%)             | 62 (20%)             |
| 51 – 60     | 20                   | 35                   |
| ≥61         | 8                    | 6                    |
| Unknown     | 2                    | 0                    |
| Nationality |                      |                      |
| Singapore   | NA                   | 151 (48%)            |
| Malaysia    | NA                   | 30 (9%)              |
| Bangladesh  | NA                   | 65 (21%)             |
| India       | NA                   | 16 (5%)              |
| China       | NA                   | 20 (6%)              |
| Others      | NA                   | 31 (10%)             |

NA: Not available

Table 4. Physical Work Stresses among Cases Fulfilling Criteria

| Physical Work Stresses    | Total     |
|---------------------------|-----------|
| Manual handling           |           |
| Carrying                  | 217 (35%) |
| Lifting                   | 129 (21%) |
| Pulling                   | 21 (3%)   |
| Pushing                   | 17 (3%)   |
| Awkward postures          | 135 (22%) |
| Frequent bending/twisting | 21 (3%)   |
| Unspecified*              | 72 (12%)  |

\*Some of the cases were deemed unspecified as the physical work stresses could not be determined with certainty from the description of the work activities.

Table 5. Ranking of Industries with Cases Fulfilling Criteria

| Industry                                                      | n = 579   |
|---------------------------------------------------------------|-----------|
| Construction                                                  | 82 (14%)  |
| Transport and storage excluding logistics and transport       | 72 (12%)  |
| Manufacturing                                                 | 71 (12%)  |
| Wholesale and retail trade                                    | 59 (10%)  |
| Accommodation and food services                               | 56 (10%)  |
| Administrative and support activities (excluding landscaping) | 32 (6%)   |
| Education                                                     | 10 (2%)   |
| Health activities                                             | 25 (4%)   |
| Logistics and transport                                       | 16 (3%)   |
| Real estate services                                          | 18 (3%)   |
| Marine                                                        | 21 (4%)   |
| Others                                                        | 117 (20%) |
| <b>Top 5 Occupations</b>                                      |           |
| Construction worker                                           | 79 (14%)  |
| Air steward/stewardess                                        | 38 (7%)   |
| Technician                                                    | 32 (6%)   |
| Courier                                                       | 21 (4%)   |
| Cleaner                                                       | 17 (3%)   |

Table 6. Prevalence of Cases among the Top 5 Industries for 2012 (Residents)

| Industry                        | No. of Cases (Residents) | Total Workforce (Residents, in Thousands) | Prevalence (Per 100,000) |
|---------------------------------|--------------------------|-------------------------------------------|--------------------------|
| Construction                    | 3                        | 104.5                                     | 2.87                     |
| Transport and storage           | 29*                      | 189.5                                     | 15.3                     |
| Manufacturing                   | 15                       | 288.2                                     | 5.2                      |
| Wholesale and retail trade      | 26                       | 306.3                                     | 8.49                     |
| Accommodation and food services | 12                       | 129.3                                     | 9.28                     |

\*These 29 cases exclude those working in the logistics and transport sectors.

the workplace and persons commuting from abroad to work in Singapore. Among the cases of construction workers, it is likely that the majority of them were foreign workers residing in dormitories and construction worksites.

The majority (56%) of cases were given medical leave between 0 to 7 days (Table 7). STATA data analysis and statistical software version 13 (StataCorp LP, Texas, USA) was used to analyse the median MC days between back injuries due to physical work stresses and trauma causes.

Table 7. Number of Days of Medical Leave among Cases Fulfilling Criteria

| No. of MC Days                               | Total (579) |
|----------------------------------------------|-------------|
| 0 – 3                                        | 33 (6%)     |
| 4 – 7                                        | 281 (49%)   |
| 8 – 14                                       | 80 (14%)    |
| 15 – 30                                      | 96 (16%)    |
| 31 – 60                                      | 56 (10%)    |
| 61 – 90                                      | 16 (3%)     |
| 91 – 180                                     | 12 (2%)     |
| >180                                         | 5 (<1%)     |
| <b>Average Length of MC in Days (Median)</b> |             |
| Male                                         | 17 (7)      |
| Female                                       | 21 (7.5)    |

MC: Medical certificate

Table 8. Two-sample Mann Whitley U Test\* on the Equality of Medians of MC Days

| No. of MC Days | Physical Work Stresses (579) | Trauma/Others (542) |
|----------------|------------------------------|---------------------|
| 0 – 3          | 33 (6%)                      | 134 (25%)           |
| 4 – 7          | 281 (49%)                    | 151 (28%)           |
| 8 – 14         | 80 (14%)                     | 74 (13%)            |
| 15 – 30        | 96 (16%)                     | 85 (16%)            |
| 31 – 60        | 56 (10%)                     | 63 (12%)            |
| 61 – 90        | 16 (3%)                      | 17 (3%)             |
| 91 – 180       | 12 (2%)                      | 13 (2%)             |
| >180           | 5 (<1%)                      | 5 (1%)              |

MC: Medical certificate

\*Two-sample Mann-Whitney U test:  $z = -0.392$ ;  $\text{Prob} > z = 0.6953$ .

Slightly more than half of cases for both groups had taken medical leave of 7 days duration or less. There appeared to be a need for longer duration of medical leave among cases with physical work stresses than the trauma group for those who had taken 7 days of medical leave or less. Using Mann-Whitley U test for 2 unmatched groups comparing their medians of MC days, we found that there was no statistical difference detected in the outcome (Table 8).

## Discussion

This review gives us an estimate of the prevalence of work-related LBP with underlying physical work stresses among the working population. LBP has a substantial impact on workers and their employers in terms of loss of income and increased healthcare expenditures. There is a strong epidemiological evidence that physical demands of

work (manual materials handling, lifting, bending, twisting and whole body vibration) can be associated with increased incidence of back symptoms and back injuries.<sup>10,11</sup>

Majority of the cases are male (78%) as it is more likely for employers to engage male workers for jobs that involve more physically demanding work. Conversely, female workers are more likely to be in jobs that are more sedentary and less physically demanding. Most of the workers are in the younger age groups. The average age for males is 36.8 years old and females 36.7 years old. The median age is the same for both genders at 35 years old.

The current study shows most common risk factors among these workers were carrying, awkward postures and lifting, which is in line with findings from the National Research Council. Studies conducted in the US and Europe showed that industries with the most cases are all associated with high physical demands and are similar to that observed in this analysis.<sup>12,13</sup> With regards to the occupations, Leigh and Sheetz<sup>2</sup> conducted a national survey in the US measuring LBP among occupational groups. In their study, the category of 'operators' would apply for the 5 occupations listed in Table 5. The relative risk for LBP for this group of workers was 2.39 as compared to managers and professionals who were assigned with a relative risk of 1.0.

By identifying the industries and occupations with the most work-related back injuries due to physical work stresses, the next step is to review these workplaces and job scopes to see if these cases can be prevented. One example would be to introduce ergonomic programmes in these industries for companies and workers. Guidance can be provided for employers in doing risk assessments and implementing control measures to protect their workers. Employers should be encouraged to share good practices.

The temporary incapacity payout under the Work Injury Compensation Act covers medical leave wages and medical expenses. For cases that have permanent incapacity, a lump sum is also payable based on the extent of the incapacity determined by the doctor. With regards to the length of medical leave, most workers (54%) only required short durations of sick leave between 0 to 7 days. There were 23 out of 759 workers who did not require any medical leave. Generally for minor back injuries, studies by Andersson and Burton have shown that workers should be encouraged to continue to work or return to work within a few days or weeks, even if they still have symptoms because giving them longer medical leave than necessary may not help improve their symptoms.<sup>14,15</sup> In practice, physicians should advise workers on the proper work postures and monitoring of backache symptoms during the recovery process. In order to make more meaningful analysis, it would be worthwhile to classify the diagnoses of the individuals and correlate that with the length of medical leave. A recent study by

Rainville et al has revealed variations in physician advice on return to work and that recommendations often reflect personal attitudes of the physicians and their perception of the seriousness of symptoms.<sup>16</sup> Healthcare professionals treating workers with work-related back injuries should familiarise themselves with the workers' work environment and prescribe appropriate return-to-work advice, or even suspend them if the injury warrants it. Assisting workers to remain at work, or in early return to work, has proven to be the most effective means of minimising future symptoms, sickness absence and claims.<sup>17,18</sup> At times, workers may require temporary work modifications or re-assignments, e.g. being excused from carrying heavy load while awaiting symptoms to improve and also to allow workers to regain confidence in their abilities. It might also be necessary to take the differences in physiques between the 2 genders into account during the design and layout of the work stations or processes, in other words, fitting the work to the worker.

A literature review undertaken by Peninsula Medical School in the United Kingdom (UK) found that early intervention for workers with lower back pain not only enabled them to return to work up to 5 weeks sooner than under normal care, but also helped to minimise recurrence of back pain in the following year by up to 40%.<sup>19</sup> The 3 key principles for effective early intervention are:

1. Holistic care based on the biopsychosocial model. Biological refers to the disease or condition; psychological refers to the impact and perceived impact on mental health and well-being; and the social refers to broader determinants that can have a negative impact on health and well-being including work, home or family situation. This model integrates these components simultaneously.
2. Multidisciplinary teams. They can provide a range of services according to individual's needs. Some examples of successful interventions include exercise, cognitive behavioural therapy, organisational changes, educational input plus other ancillary resources to address housing and financial concerns, if necessary.
3. Case managers or social workers who can assist the individual navigate the system and facilitate communication between workers, employers and their clinicians.

Healthcare professionals should also be proactive in giving ergonomic advice to workers involved in physically demanding jobs. Opportunities for such advice to be given can happen during pre-employment screening or annual medical examination for certain industries dealing with known hazards. They are also in position to give feedback to employers, especially those with more workers suffering from LBP or back injuries due to physical work stresses at work. Healthcare professions like occupational medicine

specialists can assist employers by conducting workplace ergonomic assessments to give recommendations on improving workstation designs or perform task analysis to modify the tasks involved.

Work-related musculoskeletal disorders (WRMSDs), of which work-related LBP is a subset of, can affect workers across all industries. To highlight the significance of WRMSDs, back injury cases with ergonomic risks were included as occupational diseases into the Workplace Safety and Health Report, 2013, National Statistics report. This signals the importance to drive efforts to prevent WRMSDs at the workplace.<sup>20</sup>

MOM and the Workplace Safety and Health Council (WSHC) have also launched a set of Workplace Safety and Health (WSH) guidelines on ergonomics 'Improving Ergonomics in the Workplace' to provide guidance on establishing and implementing an in-house ergonomics programme and developing good ergonomic practices in the workplace.<sup>21</sup> In addition to the guidelines, employers and employees can also refer to the Approved Codes of Practice for Office Ergonomics and Manual Handling published by SPRING Singapore.

In addition, companies that wish to embark on work redesign to eliminate or reduce ergonomic risks can also apply for the relevant funding under WorkPro which is a scheme jointly developed by MOM and the Singapore Workforce Development Agency (WDA) to augment local manpower, foster progressive workplaces and strengthen the Singaporean core in our workforce.

### Strengths and Limitations

This is the first review of the notifications of back injury cases to MOM. It has highlighted industries with higher prevalence and the associated occupations and job scopes that resulted in the workers' symptoms and injuries. However, there is likely to be under-notification of cases. We are also not able to extrapolate the data to estimate the prevalence of LBP or back injuries among our working population.

Given that the aetiology of LBP is so extensive, to assume that all back injury cases were directly associated with work can be imprudent. Even though there is strong evidence that physical demands of work are a risk factor for the onset of LBP and back injuries, there are studies to show that overall, the size of the effect is less than that of other constitutional, non-work-related and unknown factors.<sup>22</sup> No data is available on non-work-related factors for this group of workers such as previous back injuries or underlying medical disorders.

The decision to determine whether a case has underlying

physical work stresses or not was based on the incident description provided by the informant. In order to minimise under-estimation, the inclusion criteria was set broadly to identify cases. For most of the cases, we can deduce the potential physical work stresses from the descriptions. For cases with limited information, the practical decision was to refer to similar job scopes and make reasonable assumptions. Some cases that were obviously non-traumatic had limited information about the mechanism of injury and the physical work stresses were deemed to be unspecific. Such cases accounted for 12% of all the cases meeting our criteria and are randomly distributed amongst different industries.

### Conclusion

From the study, we have identified cases of LBP with physical work stresses which can help in the implementation of preventive measures. Both employers and employees should be familiar with their work processes and understand the hazards involved. Employers can apply the hierarchy of controls to minimise such injuries. When necessary, training can be provided for employees to educate them on manual handling techniques. In this era of workplace health promotion and prevention, everyone from healthcare professionals, employers to workers have to play their part to adopt safe work practices in order to prevent these injuries from happening. This will lead to improved productivity and savings for both employers and employees and better health outcomes for the employees.

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## Appendix 1

### Incident Reporting Requirements

| Category      | What Needs to Be Reported                                           | Who to Report      | Need to Notify Commissioner Immediately? | Need to Submit Report within 10 Days from Accident/Diagnosis of Disease? |
|---------------|---------------------------------------------------------------------|--------------------|------------------------------------------|--------------------------------------------------------------------------|
| Work accident | Employee was injured in accident and:                               | Employer           |                                          |                                                                          |
|               | • Died, or                                                          |                    | Yes                                      | Yes                                                                      |
|               | • Hospitalised for at least 24 hours; or                            |                    | No                                       | Yes*                                                                     |
|               | • Given MC for more than 3 calendar days (consecutive or otherwise) |                    | No                                       | Yes,*within 10 days from the 4 <sup>th</sup> day of medical leave        |
| Work accident | A member of public or self-employed contractor was injured and:     | Workplace occupier |                                          |                                                                          |
|               | • Died, or                                                          |                    | Yes                                      | Yes                                                                      |
|               | • Sent to hospital for treatment                                    |                    | Yes                                      | Yes                                                                      |

\*If the employee subsequently dies from the injury, the employer must notify the Commissioner as soon as he knows of the death.

## Sevoflurane Output in the Isoflurane/Halothane Diamedica Draw-over Vaporiser

Woo Chiao Tay, <sup>1</sup>*MBBS*, Wah Tze Tan, <sup>2</sup>*MBBS, M Med (Anaes)*

### Abstract

**Introduction:** Draw-over anaesthesia remains an attractive option for conduct of anaesthesia in austere conditions. The Diamedica Draw-over Vaporiser (DDV) is a modern draw-over vaporiser and has separate models for isoflurane/halothane and sevoflurane. **Materials and Methods:** A laboratory study was done to measure sevoflurane output in an isoflurane/halothane DDV. We did 3 series of experiments with the isoflurane/halothane DDV. We measured anaesthetic agent output in both push-over and draw-over setups, and at minute ventilation of 6 L/min and 3 L/min. Series 1 experiment was done with isoflurane in the DDV at ambient temperature of 20°C. Series 2 experiment was done with sevoflurane in the DDV at ambient temperature of 20°C. Series 3 experiment was done with sevoflurane in the DDV and with the DDV placed in a water bath of 40°C. **Results:** The sevoflurane output was found to be two-thirds of the isoflurane/halothane DDV dial setting at ambient temperature of 20°C. With the DDV in a 40°C water bath, the sevoflurane output was found to be about the isoflurane/halothane DDV dial settings. **Conclusion:** In our experiment, we show that it is possible to use sevoflurane in an isoflurane/halothane DDV.

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**Key words:** Anaesthetics, Disaster medicine, Inhalation, Military medicine

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<sup>1</sup>Department of Anaesthesia, National University Hospital, Singapore

<sup>2</sup>Department of Anaesthesia, Jurong Health Services, Singapore

Address for Correspondence: Dr Tay Woo Chiao, Department of Anaesthesia, National University Hospital, 5 Lower Kent Ridge Road, Singapore 119074.

Email: woo\_chiao\_tay@nuhs.edu.sg

## Sevoflurane Output in the Isoflurane/Halothane Diamedica Draw-over Vaporiser

Woo Chiao Tay,<sup>1</sup> MBBS, Wah Tze Tan,<sup>2</sup> MBBS, M Med (Anaes)

### Abstract

**Introduction:** Draw-over anaesthesia remains an attractive option for conduct of anaesthesia in austere conditions. The Diamedica Draw-over Vaporiser (DDV) is a modern draw-over vaporiser and has separate models for isoflurane/halothane and sevoflurane. **Materials and Methods:** A laboratory study was done to measure sevoflurane output in an isoflurane/halothane DDV. We did 3 series of experiments with the isoflurane/halothane DDV. We measured anaesthetic agent output in both push-over and draw-over setups, and at minute ventilation of 6 L/min and 3 L/min. Series 1 experiment was done with isoflurane in the DDV at ambient temperature of 20°C. Series 2 experiment was done with sevoflurane in the DDV at ambient temperature of 20°C. Series 3 experiment was done with sevoflurane in the DDV and with the DDV placed in a water bath of 40°C. **Results:** The sevoflurane output was found to be two-thirds of the isoflurane/halothane DDV dial setting at ambient temperature of 20°C. With the DDV in a 40°C water bath, the sevoflurane output was found to be about the isoflurane/halothane DDV dial settings. **Conclusion:** In our experiment, we show that it is possible to use sevoflurane in an isoflurane/halothane DDV.

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### Introduction

Draw-over anaesthesia is an attractive option in a resource poor environment.<sup>1</sup> The Diamedica Draw-over Vaporiser (DDV) by Diamedica UK is a modern reiteration of the venerable Oxford Miniature Vaporiser (OMV).<sup>2</sup> The OMV can be used with halothane, trichlorethylene, enflurane, isoflurane and sevoflurane. The DDV comes in 2 versions,<sup>3</sup> one for isoflurane/halothane and one for sevoflurane. The isoflurane/halothane DDV is made of stainless steel and has a capacity of 150 mL/s. Its dry weight is 2.6 kg and allows a scale from 0% to 5% (Fig. 1). The purpose of this series of experiments was two-fold. Firstly, to examine sevoflurane output when utilising the isoflurane/halothane DDV and secondly, to examine whether this vaporiser could, if required, be used in clinical practice with sevoflurane.

The saturated vapour pressures at 20°C of the inhalational anaesthetic agents are: halothane 32.4 kPa, isoflurane 31.9 kPa and sevoflurane 21.3 kPa.<sup>4</sup> The proximity of the

saturated vapour pressures of halothane and isoflurane explains why they can be used in a common DDV. The saturated vapour pressure of sevoflurane is about two-thirds of that of isoflurane/halothane. Saturated vapour pressure increases with increasing temperature. We did a series of experiments to measure sevoflurane output in an isoflurane/halothane DDV under varying conditions.

### Materials and Methods

Three series of experiments were performed. The anaesthesia circuits used for the experiments are shown in Figure 2. We had different configurations for push-over and draw-over setups.

### Standardisations

Ethical approval was not required as this was an equipment-based study with no patient involvement. The

<sup>1</sup>Department of Anaesthesia, National University Hospital, Singapore

<sup>2</sup>Department of Anaesthesia, Jurong Health Services, Singapore

Address for Correspondence: Dr Tay Woo Chiao, Department of Anaesthesia, National University Hospital, 5 Lower Kent Ridge Road, Singapore 119074.

Email: woo\_chiao\_tay@nuhs.edu.sg



Fig. 1. Diamedica Draw-over Vaporiser (DDV) for isoflurane/halothane. It is a common vaporiser for halothane and isoflurane.

DDV used came from the Diamedica Portable Anaesthesia System (DPA 01) purchased by the Department of Surgery, National University of Singapore (NUS).

The schematic diagram of the set-up is as shown in Figure 2. The ventilator used is the Impact® 731 Series model EMV+® transport ventilator. Two-minute ventilation targets were chosen: 6 L/min (500 mL tidal volume x 12 breaths per minute) for simulation of an adult patient and 3 L/min (150 mL tidal volumes x 20 breaths per minute) for simulation of a paediatric patient. All experiments were run twice and the average values charted and plotted.

The isoflurane and sevoflurane were produced by Baxter Healthcare (Asia) and Abbott Laboratories, respectively. We did not examine halothane output as it is no longer available in Singapore. Anaesthetic agent output was measured using a CARESCAPE Monitor B850 system from GE Healthcare. A Draeger anaesthesia gas scavenging unit attached to the hospital's operating room active scavenging system was used to scavenge the expired gases.

The DDV was filled with 100 mL of anaesthetic agent before each run of the experiment and the temperature of the DDV was allowed to stabilise for 15 minutes before each run.

#### Series 1: Verification of Isoflurane Output at 20°C

We measured the DDV's isoflurane output at ambient

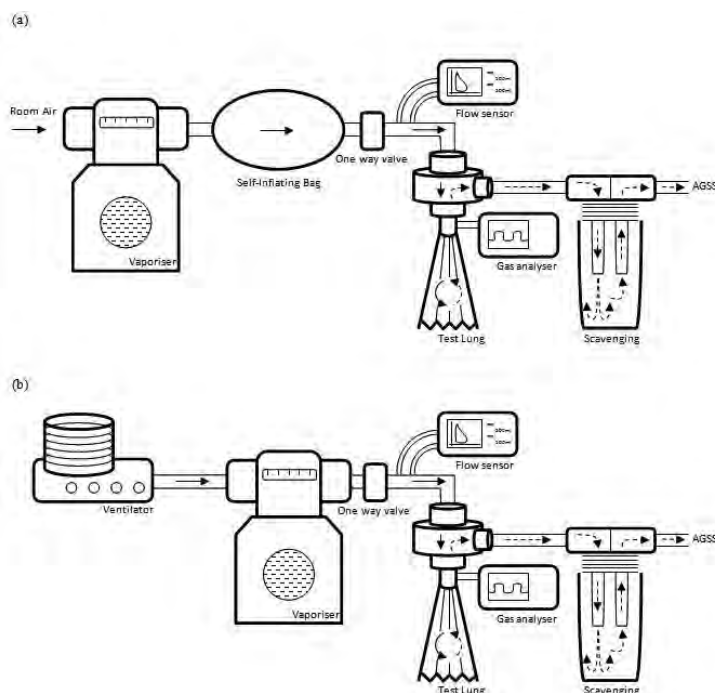


Fig. 2. Schematic diagram of the bench test set up of (a) draw-over circuit and (b) push-over circuit. The solid arrows (→) represents the theoretical inspiratory flow of gas, while the broken arrows (---→) represents the expiratory flow. AGSS: Anaesthetic gas scavenging systems.

temperature of 20°C using both push-over and draw-over setups. Isoflurane output was recorded at the 0.5- and 1-minute mark with dial settings of 3%, 4% and 5%, with minute ventilation of 6 L/min and 3 L/min at each dial setting.

#### Series 2: Sevoflurane Output at 20°C

In this experiment, we measured the sevoflurane output in both the push-over and draw-over setups at ambient temperature of 20°C. Sevoflurane output was recorded every 30 seconds over a 5-minute period at dial settings of 3%, 4% and 5% with minute ventilation of 6 L/min and 3 L/min.

#### Series 3: Sevoflurane Output in Water Bath at 40°C

In this experiment, we measured the sevoflurane output in both the push-over and draw-over setups with the DDV in a water bath of 40°C. Sevoflurane output was recorded every 30 seconds over a 5-minute period at dial settings of 3%, 4% and 5% with minute ventilation of 6 L/min and 3 L/min.

### Results

#### Series 1: Verification of Isoflurane Output at 20°C

At an ambient temperature of 20°C, the isoflurane output from the isoflurane/halothane DDV was found to be within

0.5% (a standard as used by Payne et al)<sup>8</sup> of its dial settings at 3%, 4% and 5% at minute ventilation at 6 L/min and 3 L/min (Table 1).

### Series 2: Sevoflurane Output at 20°C

The sevoflurane output from the isoflurane/halothane DDV at ambient temperature of 20°C was found to be two-thirds of the dial settings. The push-over setup yielded similar results to the draw-over setup (Table 2). Within the push-over and draw-over groups, minute ventilation (6 L/min or 3 L/min) did not affect the output of sevoflurane.

### Series 3: Sevoflurane Output in Water Bath at 40°C

When the isoflurane/halothane DDV was immersed in a water bath with a temperature of 40°C, the sevoflurane output concentration was found to be about the dial lever settings (Fig. 3). There were minimal difference in sevoflurane output for both draw-over and push-over setups and there was also minimal difference (<0.5%) in sevoflurane output between minute ventilation of 6 L/min and 3 L/min.

## Discussion

### Accuracy and Consistency of DDV

In Series 1 experiment, we attempted to verify the internal accuracy of the dial setting of the isoflurane/halothane DDV to its measured isoflurane output. At ambient temperature of 20°C, the output of isoflurane measured corresponded to the dial setting in both push-over and draw-over setups at minute ventilations of 6 L/min and 3 L/min.

In our experiments, we used both push-over and draw-over setups. Previous studies have shown no differences in concentration output between push-over and draw-over on

the OMV50 Vaporiser<sup>5,6</sup> and Universal Portable Anesthesia Complete (PAC) vaporiser.<sup>7</sup> These bench studies were conducted using halothane and different vaporisers. Payne et al<sup>8</sup> compared the concentration using draw-over and continuous flow methods with a sevoflurane dedicated DDV. English et al<sup>2</sup> compared intermittent (draw-over) and continuous flow methods for isoflurane/halothane DDV. The results from our Series 1 experiment showed that there was minimal difference between push-over and draw-over setups when using isoflurane.

### Using Sevoflurane in Isoflurane/Halothane DDV

In our Series 2 experiment, we placed sevoflurane into the isoflurane/halothane DDV. When operating at ambient temperature of 20°C, the output concentration of sevoflurane remained relatively steady over the time period of our experiment.

Sevoflurane output concentration was found to be around two-thirds the dial settings on the isoflurane/halothane DDV. This was consistent using either the draw-over or push-over setup at minute ventilation of 6 L/min and 3 L/min. The measured output concentrations were consistent with an expected two-thirds value as predicted from saturated vapour pressures (sevoflurane has a saturated vapour pressure value of approximately two-thirds that of isoflurane/halothane).

When set at 5% using the isoflurane/halothane DDV, the sevoflurane output was about 3%. This is 1.5 times the minimal alveolar concentration (MAC) of sevoflurane. This concentration of sevoflurane should be enough for maintenance of balanced general anaesthesia under intermittent positive pressure ventilation (IPPV). It should also be sufficient for general anaesthesia under spontaneous ventilation with generous amounts of opioids or

Table 1. Output Concentration of Isoflurane Using the Isoflurane/Halothane DDV in Push-over and Draw-over

|                             | Dial Setting |       |           |       |
|-----------------------------|--------------|-------|-----------|-------|
|                             | Draw-over    |       | Push-over |       |
|                             | Time         |       |           |       |
|                             | 0.5 min      | 1 min | 0.5 min   | 1 min |
| Minute ventilation: 6 L/min |              |       |           |       |
| Concentration               |              |       |           |       |
| 3%                          | 2.9          | 2.9   | 3.0       | 3.0   |
| 4%                          | 3.9          | 3.7   | 3.9       | 3.8   |
| 5%                          | 4.8          | 4.7   | 4.9       | 4.7   |
| Minute ventilation: 3 L/min |              |       |           |       |
| Concentration               |              |       |           |       |
| 3%                          | 2.8          | 2.7   | 2.8       | 2.8   |
| 4%                          | 3.7          | 3.7   | 3.8       | 3.7   |
| 5%                          | 5.0          | 5.0   | 5.1       | 5.1   |

DDV: Diamedica Draw-over Vaporiser

Table 2. Concentration of Sevoflurane Output at Different Minute Ventilation and Concentration, using Draw-over and Push-over\*

|                             | Time (Min) |     |     |     |     |     |     |     |     |     |     |
|-----------------------------|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|                             | 0          | 0.5 | 1   | 1.5 | 2   | 2.5 | 3   | 3.5 | 4   | 4.5 | 5   |
| <b>Draw-over</b>            |            |     |     |     |     |     |     |     |     |     |     |
| Minute ventilation: 6 L/min |            |     |     |     |     |     |     |     |     |     |     |
| Concentration               |            |     |     |     |     |     |     |     |     |     |     |
| 3%                          | 0          | 2.3 | 2.2 | 2.2 | 2.1 | 2.1 | 2   | 2.1 | 2   | 2   | 2.1 |
| 4%                          | 0          | 2.6 | 2.5 | 2.5 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 | 2.3 |
| 5%                          | 0          | 3.5 | 3.3 | 3   | 3.1 | 3   | 2.9 | 2.9 | 2.9 | 2.9 | 2.9 |
| Minute ventilation: 3 L/min |            |     |     |     |     |     |     |     |     |     |     |
| Concentration               |            |     |     |     |     |     |     |     |     |     |     |
| 3%                          | 0          | 2   | 2   | 1.9 | 1.9 | 1.9 | 1.9 | 1.9 | 1.9 | 1.9 | 1.8 |
| 4%                          | 0          | 2.7 | 2.7 | 2.6 | 2.6 | 2.6 | 2.6 | 2.5 | 2.5 | 2.5 | 2.5 |
| 5%                          | 0          | 3.7 | 3.6 | 3.6 | 3.5 | 3.5 | 3.5 | 3.5 | 3.4 | 3.4 | 3.4 |
| <b>Push-over</b>            |            |     |     |     |     |     |     |     |     |     |     |
| Minute ventilation: 6 L/min |            |     |     |     |     |     |     |     |     |     |     |
| Concentration               |            |     |     |     |     |     |     |     |     |     |     |
| 3%                          | 0          | 1.9 | 1.9 | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 | 1.7 | 1.7 |
| 4%                          | 0          | 2.5 | 2.4 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 | 2.3 | 2.2 | 2.2 |
| 5%                          | 0          | 3.1 | 3   | 2.9 | 2.9 | 2.8 | 2.8 | 2.8 | 2.7 | 2.7 | 2.7 |
| Minute ventilation: 3 L/min |            |     |     |     |     |     |     |     |     |     |     |
| Concentration               |            |     |     |     |     |     |     |     |     |     |     |
| 3%                          | 0          | 1.9 | 1.9 | 1.9 | 1.9 | 1.9 | 1.8 | 1.8 | 1.8 | 1.8 | 1.7 |
| 4%                          | 0          | 2.6 | 2.5 | 2.5 | 2.5 | 2.5 | 2.4 | 2.4 | 2.4 | 2.4 | 2.4 |
| 5%                          | 0          | 3.7 | 3.6 | 3.6 | 3.5 | 3.5 | 3.4 | 3.4 | 3.4 | 3.4 | 3.3 |

\*All experiments were done at ambient temperature of 20°C.

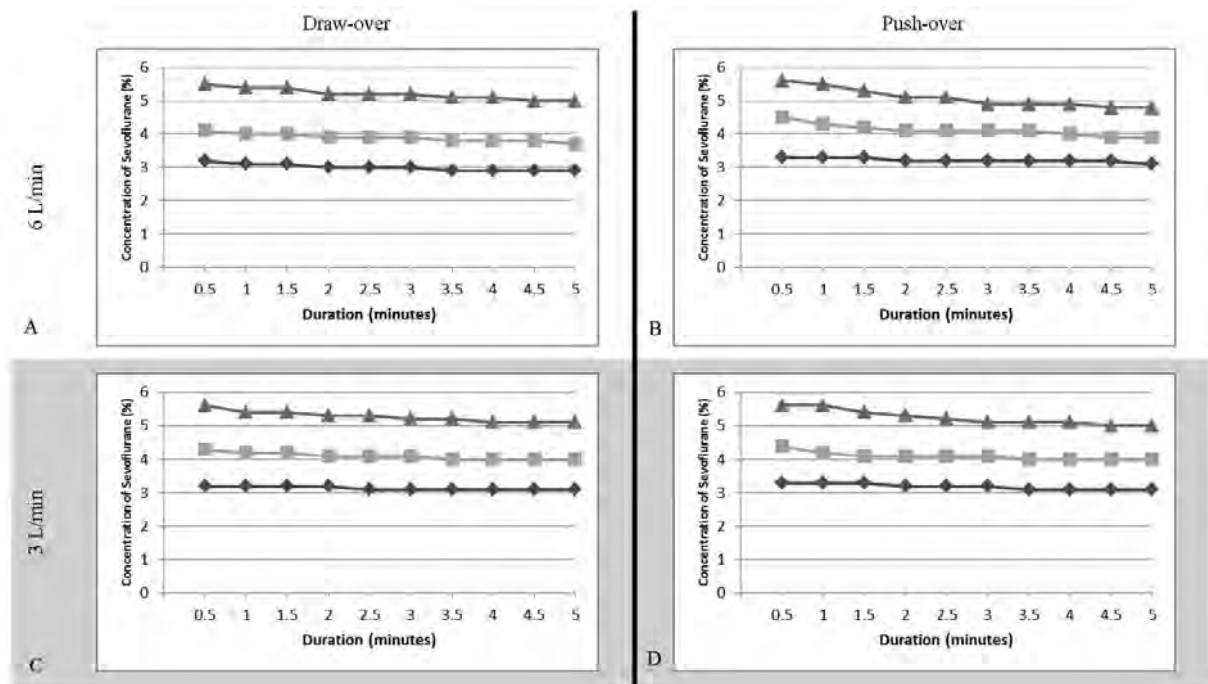


Fig. 3. Concentration of sevoflurane output at minute ventilation of 6 L/min (A and B) and 3 L/min (C and D) at concentration dial setting at 3% (◆), 4% (■) and 5% (▲). This was done with DDV in water bath set at 40°C using draw-over (A and C) and push-over (B and D) method.

premedication with benzodiazepines. However, the highest sevoflurane concentration of 3% would be insufficient to conduct routine inhalational induction. Pylman and Teiken encountered similar results with Ohmeda Universal PAC draw-over vaporiser, achieving a maximum concentration of 3.6%.<sup>9</sup>

To overcome the above problem, Diamedica UK has produced a dedicated sevoflurane DDV<sup>3,8</sup> and as an alternative solution, some authors have experimented with connecting 2 draw-over vaporisers in series.<sup>10,11</sup> We found that inhalational induction doses of sevoflurane (4% to 8% in adults<sup>12-15</sup> and up to 12% in children)<sup>16-19</sup> could be achieved by immersing the isoflurane/halothane DDV in a warm water bath of 40°C as shown in the Series 3 experiment. Under Series 3 experiment conditions, sevoflurane output concentrations are about the dial lever setting on the isoflurane/halothane DDV. This is because at higher temperatures, the SVP will increase and hence, the output will increase (20.9 kPa at 20°C, 26.2 kPa at 25°C, 42.3 kPa at 36°C)<sup>20</sup> compared to SVP of isoflurane (31.7 kPa at 20°C, 39.3 kPa at 25°C, 60 kPa at 35°C).<sup>21</sup> With this setup, induction doses ( $\geq 4\%$ ) of sevoflurane output were achievable.

Lastly, the authors must highlight safety concerns regarding the use of non-specified agent in a dedicated vaporiser. However, the same safety concerns also exist with the universal OMV, another vaporiser that can be used with a variety of different volatile agents. In these situations, clear labeling of which agent is being used is important. The use of end-tidal anaesthetic agent monitor will also help to improve the safety profile.

## Conclusion

In our experiments, we have shown that it is possible to achieve clinically useful sevoflurane output in an isoflurane/halothane DDV. At ambient temperature of 20°C, the sevoflurane output was found to be two-thirds of the isoflurane/halothane DDV dial setting (as predicted from SVP). In a water bath at 40°C, the sevoflurane output was found to be approximate to the isoflurane/halothane DDV dial setting.

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## Patterns and Predictors of Dropout from Mental Health Treatment in an Asian Population

Vathsala Sagayadevan, <sup>1</sup>*BSc*, Mythily Subramaniam, <sup>2</sup>*MBBS, MHS*, Edimansyah Abdin, <sup>3</sup>*PhD*, Janhavi Ajit Vaingankar, <sup>4</sup>*MSc*, Siow Ann Chong, <sup>5</sup>*MBBS, M Med, MD*

### Abstract

**Introduction:** Studies examining mental health treatment dropout have primarily focused on Western populations and less so on Asian samples. The current study explored the prevalence and correlates of mental health treatment dropout across the various healthcare sectors in Singapore. **Materials and Methods:** Data was utilised from the Singapore Mental Health Study (SMHS), a cross-sectional epidemiological survey conducted among an adult population (n = 6616) aged 18 years and above. Statistical analyses were done on a subsample of respondents (n = 55) who had sought treatment from the various treatment providers (i.e. mental health, medical, social services and religious healers) in the past 12 months. The World Mental Health (WMH) Composite International Diagnostic Interview version 3.0 (CIDI 3.0) was used to determine diagnoses of mental disorders, chronic medical disorders and service utilisation. **Results:** Of those who had received treatment, 37.6% had ended treatment prematurely, 23.2% had completed treatment and 39.2% were still in treatment. The religious and spiritual sector (83.1%) had the highest dropout, followed by the general medical sector (34.6%), mental health services sector (33.9%) and the social services sector (30%). Marital status emerged as the only sociodemographic factor that significantly predicted treatment dropout—with those who were married being significantly less likely to drop out than those who were single. **Conclusion:** The overall dropout rate across the various healthcare sectors was comparable to past studies. While the small sample size limits the generalisability of findings, the current study provides useful insight into treatment dropout in an Asian population.

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**Key words:** Attrition, Mental illness, Service providers

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<sup>1</sup>Research Division, Institute of Mental Health, Buangkok Green Medical Park, 10 Buangkok View, Singapore 539747.

Address for Correspondence: Ms Vathsala Sagayadevan, Research Division, Institute of Mental Health, Buangkok Green Medical Park, 10 Buangkok View, Singapore 539747.

Email: vathsala\_sagayadevan@imh.com.sg

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Vathsala Sagayadevan, <sup>1</sup>BSc, Mythily Subramaniam, <sup>2</sup>MBBS, MHS, Edimansyah Abdin, <sup>3</sup>PhD, Janhavi Ajit Vaingankar, <sup>4</sup>MSc, Siow Ann Chong, <sup>5</sup>MBBS, M Med, MD

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### Introduction

Outpatient dropout can be defined as the act of “stopping before completing the recommended course of treatment”.<sup>1</sup> In comparison to barriers to treatment access, relatively less is known about the prevalence and predictors of treatment dropout.<sup>2</sup> Nevertheless, the study of treatment dropout is important for several reasons. Firstly, previous studies have found a strong association between treatment retention and clinical improvement.<sup>3,4</sup> Individuals who leave treatment prematurely are not only less likely to recover independently<sup>5</sup> but are also more likely to be rehospitalised<sup>6</sup> and have a relapse.<sup>7</sup> An understanding of the risk factors associated with treatment dropout enables treatment providers to identify patients who might be at risk of dropout and successively take measures to retain them in treatment.

Secondly, prevalence of treatment dropout is to some extent regarded as an indicator of the quality of services offered.<sup>8</sup> Insights gleaned in this area can be used to assess the match between patients’ needs and services offered which in turn provides useful information in improving services to better accommodate the needs of patients.<sup>5</sup>

Research findings in the area of dropout have, by and large, been mixed, given the underlying differences in study designs, structure of healthcare systems (e.g. public funding of healthcare), sample composition, and varying definitions of treatment dropout.<sup>6,9-11</sup> The World Health Organization’s (WHO) World Mental Health (WMH) Survey Initiative found the prevalence rate of mental health treatment dropout across 24 countries to be 31.7%,<sup>9</sup> whereas an epidemiological study conducted among respondents in

<sup>1</sup>Research Division, Institute of Mental Health, Buangkok Green Medical Park, 10 Buangkok View, Singapore 539747.

Address for Correspondence: Ms Vathsala Sagayadevan, Research Division, Institute of Mental Health, Buangkok Green Medical Park, 10 Buangkok View, Singapore 539747.

Email: vathsala\_sagayadevan@imh.com.sg

the United States and Ontario, Canada, found the prevalence rate of mental health treatment dropout to range between 17% to 22%.<sup>2,9</sup>

A large majority of research however, has focused on Western populations, with only a handful of studies having examined treatment dropout in an Asian sample. Pan et al<sup>12</sup> for instance, noted the prevalence rate of early attrition among Taiwanese patients seeking treatment for depression to be 41.6%. Khazaie et al,<sup>4</sup> on the other hand, reported a dropout rate of 80% and 20% among Iranian patients who sought psychotherapy and pharmacotherapy treatment, respectively. Some of these studies have identified culture and ethnicity as a possible factor in influencing the use of mental health services and the level of engagement in these services.<sup>3,10,13</sup> Asian Americans, for instance, were not only less likely than Euro-Americans to utilise mental health services<sup>14</sup> but also tended to have a lower level of mental health service engagement compared to white youths.<sup>15</sup>

A wide array of factors have been examined as potential risk factors of treatment dropout. In particular, being younger, male, belonging to an ethnic minority, being divorced, low level of education, unemployment, and low income have been consistently associated with a higher likelihood of treatment dropout.<sup>1,4,16</sup>

Given that existing literature on mental health treatment dropout has predominantly focused on a relatively homogeneous Western population, the extent to which these findings can be generalised to an Asian population is unclear. Furthermore, given that there is some evidence suggestive of ethnic/cultural differences in the treatment dropout rate, it is of interest to explore the prevalence and correlates of treatment dropout in a multi-ethnic Asian population of Singapore.

Singapore is a city-state of 712.4 km<sup>2</sup> in Southeast Asia with a 5-million multi-ethnic population. Of its residents, 74.2% are of Chinese descent, 13.4% are Malays, and 9.2% are of Indian descent.<sup>17</sup> It has a dual healthcare system with a public and private sector. Mental health services are provided mainly by psychiatrists and primary care physicians (PCP) or general practitioners (GPs). A recent study<sup>18</sup> showed that out of those who had at least 1 mental disorder in their lifetime (n = 878), only 31.7% (n = 267) had sought some form of help. Majority of those with mental illnesses consulted mental health providers (15.7%, n = 117) for help. Of those who sought help from non-mental health professionals, the most popular were counsellors and medical social workers (12.7%, n = 111), followed by other medical professionals (9.1%, n = 86; of whom 84.3%, n = 75 were GPs) and religious/spiritual advisors or other healers (7.6%, n = 59).

The present study seeks to elucidate the prevalence and correlates of mental health treatment dropout across the

various treatment sectors in a multi-ethnic Asian population of Singapore.

## Materials and Methods

### *Sample*

The Singapore Mental Health Study (SMHS) is a nationally representative survey of the adult Singapore residents aged 18 years and above conducted from December 2009 to December 2010. Completed interviews were obtained from 6616 respondents giving a survey response rate of 75.9%. Disproportionate stratified sampling was used to sample the 3 main ethnic groups (Chinese, Malays and Indians) in equivalent proportion of about 30% each rather than in proportion to the ethnic distribution in the general population. The rest belonged to 'Other' ethnic groups. Face-to-face interviews were conducted by trained professional survey interviewers. The current study utilised a subsample of 55 respondents who had sought treatment from the various treatment providers in Singapore (i.e. mental health, medical, social services, and religious healers) in the past 12 months. The study was approved by the relevant institutional ethics committee (National Healthcare Group, Domain Specific Review Board) and written informed consent was obtained from all participants and parents of participants for those aged 18 to 20 years (age of majority is 21 years in Singapore). The study methodology is described in detail in an earlier article.<sup>19</sup>

### *Instruments*

#### Sociodemographic Information

Sociodemographic information was collected using a structured questionnaire. This included age at interview (18 to 34, 35 to 49, and 50 to 64 years), gender, ethnicity (Chinese, Malay, Indian, and Others), income (<SGD 20,000, SGD 20,000 to 49,999 and >SGD 50,000), marital status (never married, married, divorced or separated, and widowed), educational level (primary and below, secondary, and tertiary) and employment status (employed, economically inactive students and housewives, and unemployed).

#### *Composite International Diagnostic Interview Version 3.0 (CIDI 3.0)*

#### Diagnoses of Mental Disorders

The WMH Composite International Diagnostic Interview version 3.0 (CIDI 3.0)<sup>20</sup> was used to establish a 12-month prevalence of mood disorders (major depressive disorder (MDD), dysthymia, and bipolar disorder), anxiety disorders (generalised anxiety disorder (GAD), and obsessive compulsive disorder (OCD)), and alcohol use disorders

(alcohol abuse and alcohol dependence) using the definitions and criteria of the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV). Diagnostic hierarchy rules and organic exclusion criteria were applied to all diagnoses.

### *Chronic Medical Disorders*

A modified version of the CIDI checklist of chronic medical disorders was used to assess the presence of any of the 15 chronic medical disorders which were considered prevalent in Singapore's population. These disorders were then reclassified into 8 types of physical disorders.

### *Services*

The CIDI 'Services Module' was used to determine service utilisation. Respondents were asked: "Did you ever in your lifetime go to see any of the professionals on this list for problems with your emotions, nerves, mental health, or your use of alcohol or drugs?" A list of treatment providers was then presented to the participant. This list included: a psychiatrist, a general practitioner or family physician, any other medical doctor such as a cardiologist, urologist or gynaecologist, a psychologist, a social worker, youth aid worker, child welfare officer, school counsellor or teacher, a counsellor other than a school counsellor, any other mental health professionals such as a psychotherapist or psychiatric nurse, a general nurse, an occupational therapist or other health professional, a religious or spiritual advisor like a minister, priest, monk or imam, and any other healer like a herbalist, homeopath, naturopath, chiropractor, spiritualist or traditional healer.

The data on lifetime contacts were categorised into 4 groups based on the respective service sectors:

1. Consultation with a mental health professional including a psychiatrist, psychologist or any other mental health professional.
2. Consultation with any other medical professional including a general practitioner, any other medical doctor, a nurse, an occupational therapist, or any other healthcare professional.
3. Consultation with a professional from the social services sector, including a social worker or counsellor.
4. Consultation with a religious advisor or other healers.<sup>18</sup>

### *Treatment Dropout*

As part of the services module, respondents who had sought treatment from any of the aforementioned treatment providers were asked if they had received treatment in the past 12 months for "problems with [their] emotions, nerves,

mental health or [their] use of alcohol or drugs". If they replied "yes", they were asked if treatment had stopped or if it was ongoing. Those who had stopped treatment with a provider were asked, "Did you complete the full recommended course of treatment? Or did you stop before the [provider] wanted you to stop?" Respondents who reported quitting without completing the full recommended course of treatment were classified as having dropped out from a treatment sector if they had quit all providers they had seen in that sector. A separate variable denotes dropping out from all sectors.

### *Statistical Analysis*

Statistical analyses were carried out using the Statistical Analysis Software (SAS) version 9.2. To ensure that the survey findings were representative of the Singapore population, the data were weighted to adjust for oversampling and post-stratified by age and ethnicity distributions between the survey sample and the Singapore resident population in 2007. Descriptive analyses were performed to establish the prevalence of treatment dropout and visits based on weighted data. Due to the small sample size, regression analyses were conducted in 2 steps. In the first analysis, simple logistic regression analysis was used to explore significant associations between treatment dropout, sociodemographic and clinical characteristics. Second, in order to obtain the final model which indicated the relationship between treatment dropout and the other correlates, all statistically significant predictor variables from the simple logistic analysis were simultaneously entered into the multiple logistic regression analysis using backward elimination method. Standard errors (SE) and significance tests were estimated using the Taylor series' linearisation method to adjust for the weighting. Multivariate significance was evaluated using Wald  $\chi^2$  tests based on design-corrected coefficient variance-covariance matrices. Statistical significance was evaluated at the 0.05 level using 2-sided tests.

## **Results**

### *Demographic Distribution of the Sample*

A total of 6616 respondents completed the survey. The sample comprised 51.5% females and 48.5% males with a mean age of 42 years. Majority of the sample were of Chinese descent (76.9%), currently married (62.4%), and employed (71%). The weighted prevalence of at least 1 mood, anxiety or alcohol use disorder in the past 12 months was 4.4% ( $n = 345$ ).<sup>18</sup> Details regarding the overall sample size ( $n = 6616$ ) and the prevalence of specific mental disorders in the past 12 months have been published elsewhere.<sup>21</sup> Table 1 shows the sociodemographic distribution of the current study sample.

Table 1. Demographic Distribution of the Sample (n = 55)

|                |                       | n  | %    | SE   |
|----------------|-----------------------|----|------|------|
| Age group      | 18 – 34               | 30 | 45.1 | 0.0  |
|                | 35 – 49               | 17 | 36.4 | 0.0  |
|                | 50 – 64               | 8  | 18.6 | 0.0  |
| Ethnicity      | Chinese               | 13 | 67.5 | 0.0  |
|                | Malay                 | 16 | 11.8 | 0.0  |
|                | Indian                | 21 | 12.6 | 0.0  |
|                | Others                | 5  | 8.2  | 0.0  |
| Sex            | Male                  | 19 | 48.0 | 10.0 |
|                | Female                | 36 | 52.0 | 10.0 |
| Marital status | Single                | 20 | 33.9 | 8.4  |
|                | Married               | 30 | 53.1 | 8.5  |
|                | Divorced/separated    | 5  | 13.0 | 7.5  |
| Education      | Primary and below     | 7  | 9.1  | 5.4  |
|                | Secondary             | 14 | 14.5 | 5.4  |
|                | Tertiary              | 34 | 76.4 | 7.7  |
| Employment     | Employed              | 35 | 65.3 | 10.4 |
|                | Economically inactive | 6  | 9.9  | 5.9  |
|                | Unemployed            | 9  | 24.8 | 10.2 |
| Income         | Below SGD 20,000      | 29 | 51.0 | 11.7 |
|                | SGD 20,000 – 49,999   | 16 | 31.1 | 10.7 |
|                | SGD 50,000 and above  | 6  | 18.0 | 7.6  |

SE: Standard error

### Treatment Status and Visits by Sector

Table 2 shows the treatment status and number of visits to different treatment providers in the past year. Of the 345 respondents who had at least 1 mental disorder, 15.8% (n = 55) (weighted prevalence) reported having received treatment from the various treatment providers for “problems with [their] emotions, nerves, mental health or [their] use of alcohol or drugs” in the past 12 months. Of this, 8.4% (n = 27) consulted mental health providers i.e. psychiatrists, psychologists, and other mental health professionals with a median of 3 visits, 4% (n = 17) consulted medical professionals, 3.3% (n = 16) consulted professionals in a social support setting, and 2.5% (n = 14) sought help from religious and spiritual healers. There were 54 respondents (1 missing data) who responded to the treatment dropout questions in the past year; they were classified as having ended treatment prematurely (37.6%), having completed treatment (23.2%), and still being in treatment (39.2%). The median number of visits to the religious and spiritual healers was significantly lower compared to the number of visits to mental health providers ( $P = 0.0026$ ). Among the treatment providers, those who sought help from religious

and spiritual healers reported the highest rate of dropout (premature termination) (83.1%), followed by the general medical sector (34.6%), mental health services sector (33.9%), and the social services sector (30%).

### Sociodemographic and Clinical Correlates of Dropout from Mental Health Treatment

Table 3 shows the sociodemographic and clinical characteristics of those who dropped out from mental health treatment. Simple logistic regression showed that those who were married (as compared to single) were significantly less likely to drop out from mental health treatment (OR 0.1,  $P = 0.002$ ) while those who sought help from religious and spiritual healers (as compared to mental health professionals) were more likely to drop out from mental health treatment (OR 19.1,  $P = 0.04$ ). In the backward multiple logistic regression analysis, both marital status and type of provider remained as significant correlates of dropout. Those who were married (versus single) were less likely to drop out from treatment whereas those who sought help from religious or spiritual healers were more likely to default from treatment (Table 4).

Table 2. Treatment Status and Visits by 4 Sectors in the Past Year

| Professionals                                                                       | Received Treatment |      | Number of Visits |        | 1 to 2 Visits |    | 3 or More Visits |      | Still in Treatment |      | Completed Treatment |      | Premature Termination |      |
|-------------------------------------------------------------------------------------|--------------------|------|------------------|--------|---------------|----|------------------|------|--------------------|------|---------------------|------|-----------------------|------|
|                                                                                     | n*                 | %†   | SE               | Median | IQR           | n  | %                | SE   | n                  | %    | n                   | %    | n                     | SE   |
| Any mental health professional seen                                                 | 27                 | 8.4  | 2.2              | 3      | 2             | 10 | 49.2             | 3.9  | 17                 | 50.8 | 3.9                 | 12.4 | 3                     | 12.3 |
| (psychiatrist, psychologist/other mental health professional)                       |                    |      |                  |        |               |    |                  |      | 18                 | 53.8 | 12.4                | 9.6  | 6                     | 33.9 |
| Any other medical professional seen (GP/other specialist/other health professional) | 17                 | 4    | 1.4              | 2      | 2             | 10 | 66               | 20.8 | 6                  | 34   | 20.8                | 18.5 | 5                     | 34.5 |
|                                                                                     |                    |      |                  |        |               |    |                  |      | 5                  | 30.9 | 18.5                | 18.1 | 6                     | 34.6 |
| Any professional in social support setting seen (social worker/ counsellor)         | 16                 | 3.3  | 1.2              | 1      | 0             | 10 | 85.6             | 6.3  | 4                  | 14.4 | 6.3                 | 6    | 6                     | 61.9 |
|                                                                                     |                    |      |                  |        |               |    |                  |      | 2                  | 8.1  | 6                   | 15.9 | 7                     | 30   |
| Any religious and spiritual healer seen                                             | 14                 | 2.5  | 1                | 1      | 1             | 8  | 75.9             | 7.5  | 6                  | 24.1 | 7.5                 | 6.1  | 2                     | 9    |
|                                                                                     |                    |      |                  |        |               |    |                  |      | 2                  | 7.9  | 6.1                 | 7    | 9                     | 83.1 |
| At least one professional                                                           | 55                 | 15.8 | 2.8              | 2      | 3             | 30 | 50.8             | 9.5  | 24                 | 49.2 | 9.5                 | 23.2 | 19                    | 37.6 |
|                                                                                     |                    |      |                  |        |               |    |                  |      | 25                 | 39.2 | 9                   | 8.5  | 19                    | 9.6  |

IQR: Interquartile range; SE: Standard error

\*Unweighted number of respondents who received treatment in each sector.

†Denominator is 345.

Table 3. Univariate Analyses of Sociodemographic and Clinical Characteristics of Those who Drop Out from Mental Health Treatment (n = 54)

| Sociodemographic Factors   |                                        | Treatment Dropout |      |      |     |      |      | OR    | 95% CI |       |
|----------------------------|----------------------------------------|-------------------|------|------|-----|------|------|-------|--------|-------|
|                            |                                        | No                |      |      | Yes |      |      |       | Upper  | Lower |
|                            |                                        | n                 | %    | SE   | n   | %    | SE   |       |        |       |
| Age group                  | 18 – 34                                | 18                | 48   | 13.3 | 11  | 52   | 13.3 | Ref   | -      | -     |
|                            | 35 – 49                                | 9                 | 59   | 18.8 | 8   | 41   | 18.8 | 0.6   | 4.4    | 0.1   |
|                            | 50 – 64                                | 8                 | 100  | 0.0  | -   | -    | -    | -     | -      | -     |
| Ethnicity                  | Chinese                                | 7                 | 59.4 | 13.2 | 5   | 40.6 | 13.2 | Ref   | -      | -     |
|                            | Malay                                  | 10                | 62.4 | 12.6 | 6   | 37.6 | 12.6 | 0.7   | 3.2    | 0.1   |
|                            | Indian                                 | 14                | 65.6 | 10.4 | 7   | 34.4 | 10.4 | 0.9   | 0.9    | 0.2   |
|                            | Others                                 | 4                 | 80   | 20   | 1   | 20   | 20   | -     | -      | -     |
| Sex                        | Male                                   | 12                | 52.8 | 15.4 | 7   | 47.2 | 15.4 | 2.6   | 19.6   | 0.3   |
|                            | Female                                 | 23                | 72   | 10.9 | 12  | 28   | 10.9 | Ref   | -      | -     |
| Marital status             | Single                                 | 11                | 40.5 | 16.1 | 9   | 59.5 | 16.1 | Ref   | -      | -     |
|                            | Married                                | 22                | 90.1 | 3.6  | 7   | 9.9  | 3.6  | 0.1*  | 0.4    | 0.01  |
|                            | Divorced/separated                     | 2                 | 16.2 | 14.3 | 3   | 83.8 | 14.3 | 2.9   | 50.8   | 0.2   |
| Education                  | Primary and below                      | 5                 | 84.8 | 12.9 | 2   | 15.2 | 12.9 | 0.3   | 3.6    | 0.02  |
|                            | Secondary                              | 9                 | 49   | 19.2 | 5   | 51   | 19.2 | 1.7   | 14.3   | 0.2   |
|                            | Tertiary                               | 21                | 62.2 | 12.2 | 12  | 37.8 | 12.2 | Ref   | -      | -     |
| Employment                 | Employed                               | 21                | 69.1 | 12.3 | 13  | 30.9 | 12.3 | Ref   | -      | -     |
|                            | Economically inactive                  | 5                 | 82.8 | 17.3 | 1   | 17.2 | 17.3 | -     | -      | -     |
|                            | Unemployed                             | 5                 | 33.7 | 18.9 | 4   | 66.3 | 18.9 | 4.6   | 48.8   | 0.4   |
| Income                     | Below S\$20,000                        | 17                | 40.1 | 12.1 | 11  | 59.9 | 12.1 | Ref   | -      | -     |
|                            | S\$20,000 – 49,999                     | 9                 | 68.2 | 17.2 | 7   | 31.8 | 17.2 | 0.3   | 2.4    | 0.03  |
|                            | S\$50,000 and above                    | 6                 | 100  | 0    | 0   | -    | -    | -     | -      | -     |
| Type of provider           | Any mental health professional         | 21                | 66.1 | 11.4 | 6   | 33.9 | 11.4 | Ref   |        |       |
|                            | Medical professional                   | 7                 | 64.4 | 21.7 | 5   | 35.6 | 21.7 | 0.9   | 8.8    | 0.1   |
|                            | Professional in social support setting | 6                 | 78.6 | 12.8 | 4   | 21.4 | 12.8 | 0.6   | 4.5    | 0.1   |
|                            | Religious or spiritual healers         | 1                 | 7.2  | 8.4  | 4   | 92.8 | 8.4  | 19.1* | 329.9  | 1.1   |
| Number of visits           | 1 to 2                                 | 16                | 49.1 | 13.8 | 13  | 50.9 | 13.8 | Ref   |        |       |
|                            | 3+                                     | 18                | 73.4 | 13.1 | 6   | 26.6 | 13.1 | 0.4   | 2.8    | 0.1   |
| Chronic Conditions         | No                                     | 17                | 69.8 | 11.2 | 10  | 30.2 | 11.2 | Ref   |        |       |
|                            | Yes                                    | 18                | 53.1 | 15.2 | 9   | 46.9 | 15.2 | 3.4   | 21     | 0.5   |
| Mood disorders             | No                                     | 6                 | 60   | 25.7 | 2   | 40   | 25.7 | Ref   |        |       |
|                            | Yes                                    | 29                | 62.8 | 8.3  | 17  | 37.2 | 8.3  | 1.1   | 7.9    | 0.1   |
| Anxiety disorders          | No                                     | 23                | 60.4 | 11.4 | 14  | 39.6 | 11.4 | Ref   |        |       |
|                            | Yes                                    | 12                | 65.6 | 17.8 | 5   | 34.4 | 17.8 | 1     | 7.7    | 0.1   |
| Alcohol use disorder       | No                                     | 31                | 61.6 | 9.5  | 17  | 38.4 | 9.5  | Ref   |        |       |
|                            | Yes                                    | 4                 | 74.5 | 16.7 | 2   | 25.5 | 16.7 | 0.6   | 4.8    | 0.1   |
| Number of mental disorders | 1                                      | 21                | 56.4 | 12.3 | 13  | 43.6 | 12.3 | Ref   |        |       |
|                            | 2+                                     | 14                | 73   | 14.8 | 6   | 27   | 14.8 | 0.5   | 4.1    | 0.1   |

CI: Confidence interval; OR: Odds ratio; SE: Standard error

\*P &lt; 0.05

Table 4. Results of Final Model for Multiple Logistic Regression: Correlates of Treatment Dropout (n = 54)

| Factors          | OR                                         | 95% CI |       |
|------------------|--------------------------------------------|--------|-------|
|                  |                                            | Upper  | Lower |
| Marital status   | Single                                     | Ref    | -     |
|                  | Married                                    | 0.05*  | 0.4   |
|                  | Divorced/separated                         | 5.7    | 173.0 |
| Type of provider | Any mental health professional             | Ref    | -     |
|                  | Any medical professional                   | 1.6    | 30.1  |
|                  | Any professional in social support setting | 3.8    | 44.5  |
|                  | Any religious and spiritual healer         | 71.2*  | 961.5 |

CI: Confidence interval; OR: Odds ratio

\*P &lt; 0.05

## Discussion

The current study aimed to explore the prevalence and correlates of mental health treatment dropout across the various healthcare sectors in Singapore. The overall dropout rate of 37.6% was comparable to the figure reported in the WHO World Mental Health Survey which found treatment dropout across 24 countries of varying economic status to be 31.7%.<sup>9</sup>

In examining dropout from the individual sectors of treatment providers, the religious and spiritual sector (83.1%) was found to have the highest dropout, followed by the general medical sector (34.6%), mental health sector (33.9%), and social support services sector (30%). Past studies have commonly found dropout from the general medical sector to be the highest and that from the mental health services sector to be the lowest.<sup>1,9</sup> The current finding of high dropout from the religious and spiritual sector, also known as complementary and alternative medicine (CAM) sector, concurred with the findings by Bruwer et al,<sup>22</sup> who also found dropout among these care providers to be the highest. Wang et al<sup>23</sup> attributed the high dropout from the religious and spiritual sector to be a result of mismatch between the needs of the individuals and the expertise of professionals in this sector. Compared to mental health professionals, religious and spiritual providers may not have adequate training in recognition, proper diagnosis, and knowledge concerning optimal treatment of mental disorders.<sup>23,24</sup> Lim et al<sup>25</sup> found that while the majority of CAM users did not perceive CAM to be superior or more effective than conventional Western medicine, they associated treatment in this sector with fewer side effects and regarded it to be useful in health maintenance. Likewise, Picco et al<sup>26</sup> found that over half the population who sought treatment from religious and spiritual healers had reported the use of CAM as useful, with the majority being satisfied with the support received from this sector. This disparity

between satisfaction levels and dropout rate from the sector (i.e. high dropout despite satisfaction expressed) is in line with the study by Pekarick<sup>8</sup> who found the correlation between client satisfaction and treatment effectiveness to be low. Hence, while clients may have been satisfied with the “symptomatic relief”<sup>25,27</sup> offered by CAM, the core symptoms may not have been adequately addressed. Nevertheless, it is important to note that CAM is often used to complement treatment from other sectors rather than on its own<sup>28</sup> and that dropout rate might be influenced by other variables not within the control of treatment providers.<sup>8</sup>

With the exception of the religious and spiritual sector, dropout rates from all other sectors were found to be comparable to one another, suggesting engagement in these sectors to be good. The recent move towards integrated mental healthcare and introduction of programmes such as Mental Health-General Practitioner (MH-GP) partnership programme have not only provided a platform for healthcare professionals to be equipped with skills necessary in diagnosing and detecting mental illnesses in patients,<sup>29</sup> but have also enabled mental healthcare to be delivered in a manner that is more accessible, affordable and acceptable to the population.<sup>30</sup> The comparable levels of engagement across sectors in the present study may in part be a reflection of this integration of mental healthcare into the primary care sector.

A large proportion of the sampled population had received treatment from the mental health sector. In addition, this sector also had the highest median number of visits (i.e. 3 visits), with approximately 50% of individuals found to have had 3 or more visits over the past 12 months. The latter finding parallels that of Wells et al<sup>9</sup> who also found the mental health sector to have the highest median number of visits (i.e. 2.8 to 3.5 visits). Though not explored in the current study, the median number of visits to the mental health sector was found to closely approximate what is

considered “minimally adequate treatment”.<sup>22,31</sup> In line with evidence-based guidelines, Wang et al<sup>32</sup> proposed 4 or more visits to a treatment provider to be minimally adequate, particularly during the acute and continuation phases of treatment, as this allows for medication evaluation, initiation, and monitoring. Furthermore, given that past literature has shown dropout to be the highest following 1 or 2 visits to a treatment provider<sup>9</sup> and that premature termination of treatment is largely associated with negative outcomes,<sup>5,6</sup> the adherence of individuals to 3 treatment visits (median) in the current study proves to be reassuring.

In general, Chinese ethnicity, male, being younger (18 to 34 years), divorced or separated, unemployed, having secondary level education, lower income, 1 to 2 visits to a treatment provider, presence of a chronic condition, mood and anxiety disorders (but not alcohol use disorder), and absence of comorbidity was associated with a higher likelihood of dropout from treatment. Of these factors, only marital status emerged as a significant correlate of treatment dropout with individuals who are married (as opposed to single or divorced) being significantly less likely to drop out from treatment in the adjusted analysis. According to Khazaie et al<sup>4</sup> support provided by spouses acts as a motivating factor for individuals to remain in treatment. The emphasis placed on the collective well-being of family over self in Asian societies<sup>33</sup> might also account for marital status being a significant correlate of dropout. Overall, these findings concurred with past studies which have consistently shown sociodemographic factors to be insignificant predictors of dropout, given that these factors are considered to be more crucial in determining access to treatment.<sup>9,10</sup>

### *Limitations of the Study*

Firstly, given the small sample size in the current study, the aforementioned findings should be considered preliminary. Nonetheless, given the dearth of literature on mental health treatment dropout in Asian samples, the present study offers some insight into this area. Secondly, only a subset of factors was examined as possible correlates of dropout. Past literature has examined a myriad of factors including professional factors (e.g. clinical expertise),<sup>6</sup> previous access to healthcare,<sup>21</sup> and health insurance<sup>1</sup>—all of which have been shown to have an association with treatment dropout. Consistency of correlates associated with dropout across sectors was also not examined. This might be an interesting area to look into given that correlates of dropout in one sector may vary from other sectors and might be particularly useful for targeting certain groups of individuals who may be at higher risk of dropout. Thirdly, while the present study looked into the prevalence of dropout as a whole across the healthcare sectors, the differential dropout

rate for different disorders (e.g. mood) were not studied. Furthermore, the reasons for dropout were not explored. Studies in the latter area have suggested various reasons for dropout, including attitudes of patients (e.g. belief that disorder will get better on its own, lack of perceived need for treatment),<sup>21</sup> stigma associated with seeking treatment,<sup>34</sup> and patients’ motivation and readiness for change.<sup>5</sup> Further study into possible reasons for dropout is crucial, as this allows treatment providers to identify and address potential risk factors which may threaten adherence to treatment.

Lastly, it is unclear if individuals receiving treatment from a particular sector were concurrently receiving treatment in other sectors and how this interaction between sectors influenced premature termination of treatment. Though this interaction was not explored in the current study due to insufficient sample size for certain treatment sectors, in-depth examination into this area is noteworthy given evidence to suggest receipt of treatment from multiple treatment sectors to be a protective factor against dropout.<sup>10,21</sup>

### **Conclusion**

Despite its shortcomings, our study findings offer important insights into the prevalence and correlates of treatment dropout—given that it is one of the few studies that have looked into this area within an Asian context. Although past studies offered some evidence suggestive of ethnic differences in the dropout rate, this was not observed in this current study. Marital status however, emerged as a significant sociodemographic factor in influencing treatment dropout. Treatment providers should be cognisant of this and include family members and spouses in decision-making. Further studies based on a prospective design and a larger sample is, however, needed to validate the study findings and to explore how interactions across the various healthcare sectors influence treatment dropout over time.

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## Underutilisation of Guideline-based Therapy Primary Prevention among Patients Presenting with AF-related Ischaemic Stroke

### Dear Editor,

Atrial fibrillation (AF) is the most common sustained cardiac arrhythmia with a prevalence of 1.5% in Singapore and 0.4% to 1% in the general population.<sup>1</sup> The risk of ischaemic stroke in patients with AF is increased by fivefold<sup>2</sup> and is stratified using CHA<sub>2</sub>DS<sub>2</sub>-VASc score.<sup>3</sup> AF-related strokes are associated with greater disability and mortality.<sup>4,5</sup>

Anticoagulation with warfarin and novel oral anticoagulation (NOAC) drugs significantly decreases the risk of stroke and is recommended for most patients with AF. Antiplatelet therapy also decreases stroke risk for low-risk patients but is less effective than anticoagulation.<sup>6</sup>

In published literature, utilisation of anticoagulation for primary stroke prevention is limited because of over-concern for bleeding risks,<sup>7</sup> however, there are no data on the local situation in Singapore. We aimed to study patients admitted with AF-related stroke in a tertiary hospital in Singapore to describe 1) the frequency of previously known and newly diagnosed AF; 2) distribution of CHA<sub>2</sub>DS<sub>2</sub>-VASc score prestroke and postindex-stroke and its association with total anterior circulation infarction (TACI) by Oxfordshire Community Stroke Project (OCSP) classification as a marker of severe and large stroke; and 3) utilisation of appropriate primary stroke prevention in patients with previously known AF and secondary stroke prevention strategies on discharge.

### Materials and Methods

This is an observational prospective study of consecutive AF-associated ischaemic stroke patients admitted to Singapore General Hospital from January 2012 to November 2012. The inclusion criteria were acute ischaemic stroke with previously known or newly diagnosed AF as the cardioembolic source.

Data was obtained from medical records during the acute stroke hospitalisation. Neurological severity was assessed by ward nurses who were certified for the National Institutes of Health Stroke Scale (NIHSS).<sup>8</sup> The CHA<sub>2</sub>DS<sub>2</sub>-VASc score was calculated for 2 time points: prestroke based on data at admission and postindex-stroke based on data at discharge. We defined a high stroke risk as CHA<sub>2</sub>DS<sub>2</sub>-VASc score >5 which carries an annual risk of 9.8% to 15.2% compared to 1.4% to 6.7% for a score of ≤5.<sup>9</sup> Stroke subtype was

classified using OCSP with TACI as surrogate for severe and large stroke.<sup>5</sup>

For evaluation of antithrombotic use, warfarin and the NOACs dabigatran, rivaroxaban and apixaban were considered oral anticoagulants while aspirin, dipyridamole, ticlopidine and clopidogrel were antiplatelet drugs. Double-antiplatelet therapy was defined as concomitant use of aspirin + clopidogrel or aspirin + dipyridamole. If patients were on warfarin prestroke, the international normalised ratio (INR) was noted and a range of 2 to 3 being therapeutically optimal.<sup>9</sup>

Statistical analyses were performed with SPSS software version 17.0. Descriptive data were presented as frequencies. Chi-square test was employed to determine the relationship between dichotomous variables. This study was approved by the institutional review board and waiver of consent was obtained.

### Results

Among the 60 patients with AF-related ischaemic stroke, mean age was 74.2 ± 9.4 years and median NIHSS score was 4 (interquartile range (IQR) = 11). Nine (15%) had TACI, 21 (35%) had partial anterior circulation infarction (PACI), 7 (12%) had posterior circulation infarction (POCI), 22 (37%) had lacunar infarction (LACI) and 1 had no OCSP data. Forty-seven (78%) had previously known AF prestroke and 13 (22%) had AF diagnosed during admission. All patients with previously known AF had a pre-admission CHA<sub>2</sub>DS<sub>2</sub>-VASc score of >1 with a median of 4 (IQR = 2). On discharge the median score was 6 (IQR = 2). Among 13 patients with newly diagnosed AF, the median pre-admission CHA<sub>2</sub>DS<sub>2</sub>-VASc was 4 (IQR = 2) and 6 (IQR = 2.5) on discharge. Prior to admission, 11 (18%) had CHA<sub>2</sub>DS<sub>2</sub>-VASc score of >5, while 49 (82%) had a score of ≤5. The proportion of patients with TACI was higher among those with CHA<sub>2</sub>DS<sub>2</sub>-VASc score of >5 (5 out of 11; 46%) versus those with a score of ≤5 (4 out of 49; 8.3%, *P* = 0.008). Upon recalculation of the CHA<sub>2</sub>DS<sub>2</sub>-VASc score on discharge, 32 (53%) scored >5, while 28 (47%) scored ≤5.

Prestroke and poststroke antithrombotic use per CHA<sub>2</sub>DS<sub>2</sub>-VASc score among patients with previously known AF is

shown in Figure 1. Only 10 (21%) out of 47 previously known AF patients were on anticoagulation on admission, with only 3 (30%) of these 10 having a therapeutic INR. Twenty-nine (62%) of them were on antiplatelet, 2 (4%) were on double-antiplatelet while 6 (13%) were not on any antithrombotic medication. Overall, on discharge, 30 (50%) of the 60 patients were on oral anticoagulants [24 (40%) on warfarin, 6 (10%) on NOACs], 18 (30%) were on antiplatelet agents, 5 (8%) were on double-antiplatelet, 1 (2%) was on concomitant use of warfarin + clopidogrel and 6 (10%) were not on any antithrombotic medication. Of the 37 patients with previously known AF and not on anticoagulation pre-admission, 16 (43%) were prescribed anticoagulation on discharge [12 (75%) with warfarin and 4 (25%) with NOACs], 12 (32%) were on antiplatelet, 5 (14%) were on double-antiplatelet and 4 (11%) were not on any antithrombotic medication.

## Discussion

This study found that most (79%) of the patients with known AF presenting with ischaemic stroke were not on appropriate anticoagulation, similar to many studies in developing countries such as Malaysia (16%) and China (2.7% to 50%).<sup>2</sup> Utilisation of anticoagulation for primary stroke prevention can be optimised as evidenced by a much higher rate of 85% in Europe.<sup>10</sup> Our data suggest that locally there is much room for improvement in primary stroke prevention in patients with AF. There is a known interplay between the risks and benefits of anticoagulants.<sup>7</sup> This study's finding that nearly half of known AF patients

not on anticoagulation pre-admission were discharged with anticoagulants illustrates that they had no absolute contraindication and confirms missed opportunities for primary stroke prevention.

Potential strategies to improve utilisation of anticoagulation for primary stroke prevention in AF include employing risk stratification tools.<sup>3,11</sup> The CHA<sub>2</sub>DS<sub>2</sub>-VASc score, a predictor of stroke risk in AF,<sup>3</sup> is also associated with stroke severity as confirmed by our finding that more patients with a score of >5 had TACI which is known to have a very poor prognosis.<sup>4</sup> The HAS-BLED score predicts risk of haemorrhage with anticoagulation<sup>11</sup> and is high in individuals with high CHA<sub>2</sub>DS<sub>2</sub>-VASc score due to common factors. However, it should be noted that the risk reduction with anticoagulation is higher in those with higher CHA<sub>2</sub>DS<sub>2</sub>-VASc and HAS-BLED scores<sup>9,12</sup> and HAS-BLED is proposed to recognise, address and manage factors of haemorrhagic risk rather than to restrict the use of anticoagulation.<sup>9</sup>

Only a small proportion of our stroke patients with known AF on warfarin had therapeutic INR (30%) which is similar to that in developing countries (30% to 50%).<sup>2</sup> Possible reasons for this include increased stroke risk with subtherapeutic INR<sup>9</sup> and low time in therapeutic range (TTR).<sup>13</sup> Of note, none of the patients with previously known AF who were on anticoagulation were on NOACs. This offers a potential opportunity other than warfarin especially where bleeding complications, compliance and reluctance of blood monitoring are issues. Although concern has been expressed about patient adherence, lack of specific antidotes, increased cost and not being widely

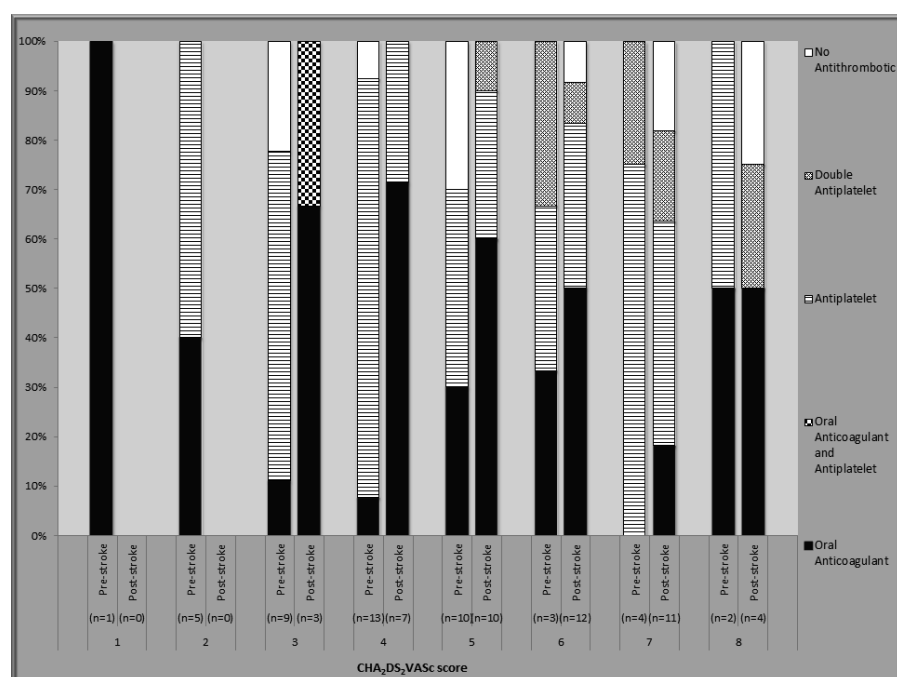


Fig. 1. Prestroke and poststroke antithrombotic use per CHA<sub>2</sub>DS<sub>2</sub>-VASc score among patients with previously known AF.

available, NOACs are as effective as warfarin for stroke prevention in non-valvular AF, with better haemorrhagic safety profiles and convenience of use.<sup>14</sup>

Strengths of this study include assessment of CHA<sub>2</sub>DS<sub>2</sub>-VASc score in both pre and post-stroke settings to assess optimal treatment as well as collation of anticoagulation use on discharge as a surrogate for the lack of absolute contraindications. The main limitation of this study is that being a chart review, the reasons for non-utilisation of anticoagulation were not readily enumerated, thus the absolute and relative contraindications were not assessed. NICE consensus recommends that local arrangements for use of antithrombotic therapies in AF should be reviewed and policies developed for integration of NOACs into the care pathway.<sup>14</sup> We did not collate data on whether the AF was paroxysmal or permanent, or the mode of detection of AF. In addition, being a single centre study may lend bias. However, as Singapore's population is homogeneously distributed, these data are likely generalisable.

## Conclusion

There was very limited use as well as clearly missed opportunities for appropriate optimal anticoagulation in known AF patients presenting with ischaemic stroke in this study, advocating the need for improvement of primary stroke prevention in AF in Singapore.

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Natasha Fabiaña,<sup>1</sup>MD, *FPNA*, Arun Pragas Ramaswami,<sup>2</sup>MD,  
Elaine SL Ang,<sup>1</sup>BSc (Hons), Deidre Anne De Silva,<sup>1</sup>FRCP

<sup>1</sup>Department of Neurology, National Neuroscience Institute, Singapore General Hospital, Singapore

<sup>2</sup>Ministry of Health Holdings, Singapore

Address for Correspondence: Dr Deidre Anne De Silva, Department of Neurology, Singapore General Hospital, Outram Road, Singapore 169608.  
Email: [deidre.a.de.silva@sgh.com.sg](mailto:deidre.a.de.silva@sgh.com.sg)

## Non-Urgent Paediatric Emergency Department Visits: Why Are They So Common? A Singapore Perspective

**Dear Editor,**

### Introduction

Over the past decade, overcrowding in emergency departments (ED) has become a serious problem in many developed countries.<sup>1,2</sup> A recent international literature review reported that between 4.8% to 90% of ED patients were potentially non-urgent cases.<sup>3,4,5</sup> This high number of non-urgent paediatric ED (PED) visits is a huge financial burden to families as well as to society, not just in financial terms, but in overcrowding and straining resources, and possibly affecting more immediate access to those who might need it for urgent medical care and attention.<sup>6,7</sup>

A few recent studies have investigated why individuals with non-urgent complaints are brought to the PED. Causes include caregiver dissatisfaction with the primary care provider (PCP), difficulty making appointments with the PCP and seeking medical attention outside of PCP working hours.<sup>8,9</sup> Other reasons include perceived reduced waiting times, the ability to have a wide range of tests and a better patient care experience at the ED.<sup>10-12</sup>

The caregiver plays an important role in determining the choice of medical attention sought for their child. Therefore, assessing and addressing caregiver perception of the need for the ED visit is essential if we are to develop successful interventional strategies to reduce the number of non-urgent PED visits. As a first step, we set out to determine reasons for these non-urgent visits as perceived by caregivers as well as ED personnel in KK Women's and Children's Hospital (KKH), the largest tertiary care paediatric hospital in Singapore.

### Materials and Methods

We conducted a cross-sectional survey with 2 study populations: caregivers and ED personnel. Self-administered questionnaires and information leaflets were given to caregivers and ED personnel over a 4-week period in March 2014.

### Study Setting and Population

The study was conducted in the paediatric ED of the KKH which attends to approximately 176,000 visits per year or

about 450 to 550 attendances daily. Patients are triaged as Priority 1 (resuscitation) to Priority 3 (non-urgent/P3). Up to 60% of our daily cohorts of about 500 patients are triaged as Priority 3.

### Results

A total of 155 questionnaires were given to the ED personnel with a response rate of 90.3% (140 respondents). A total of 980 questionnaires were distributed to caregivers with a response rate of 73.5% (720 respondents).

The caregivers' most frequently cited reasons for bringing their child to the ED were the convenience of seeing a doctor and having tests done in the same place (79.7%), the perception that the medical problems are too urgent to wait to see PCP/private paediatrician (64.9%) and the belief that the standard of medical treatment is better at the ED (62.8%). Other reasons given were that their child has previous records in the ED (61.4%), the environment in the ED is more child-friendly (49.6%) and that they were unable to see a PCP/private paediatrician as it was after operating hours (48%) (Fig. 1) (Table 1).

When asked about commonly encountered reasons for non-urgent visits, ED personnel felt that a majority of children are brought in on the advice of PCPs/private paediatricians to go to the ED if the child's condition worsens or persists (93.6%). Other common reasons were the convenience of seeing a doctor and having tests done in the same place (87.2%) and that caregivers are not confident of taking care of their unwell children (87.1%). ED personnel also perceived that parents feel it would be better to visit the ED because their children have records in the ED (86.5%) or because they are seeking a second opinion (80.8%) (Fig. 1).

When asked how they felt we could reduce the numbers of these non-urgent PED visits, the caregivers' opinion was that the best solution was to increase the number of PEDs (76.2%), followed by educating the public on the usage of the ED (73.2%) and increasing the number of 24-hour clinics (72.6%) at the PCP level. This differed from the ED personnel's opinion which was that the best solution was by educating the public on the usage of the ED (92.9%), followed by increasing the number of paediatric EDs (83.5%) and increasing the number of 24-hour clinics (82.1%) at the PCP level (Fig. 2).

Table 1. Reasons for Non-urgent Paediatric Emergency Department Visits (Caregivers and Medical Personnel)

| Statement                                           | Caregivers |     |     |         | ED Personnel |     |     |         |
|-----------------------------------------------------|------------|-----|-----|---------|--------------|-----|-----|---------|
|                                                     | Median     | P25 | P75 | % (4+5) | Median       | P25 | P75 | % (4+5) |
| Problem too urgent                                  | 4          | 3   | 4   | 64.9    | 3            | 2   | 4   | 42.8    |
| Problem too serious/complex                         | 3          | 3   | 4   | 46.2    | 3            | 2   | 4   | 39.2    |
| Better standard in ED                               | 4          | 3   | 4   | 62.8    | 4            | 3   | 4   | 63.6    |
| Seeking second opinion                              | 3          | 2   | 4   | 35.7    | 4            | 4   | 5   | 80.8    |
| Consult doctor, tests/X-ray in the same place       | 4          | 4   | 5   | 79.7    | 4            | 4   | 5   | 87.2    |
| Unable to get appointment with regular doctor       | 2          | 2   | 3   | 17.8    | 2            | 2   | 4   | 27.1    |
| After operating hours of PCP/private paediatricians | 3          | 2   | 5   | 48      | 4            | 3   | 5   | 67.8    |
| Waiting time is shorter in ED                       | 2          | 1   | 3   | 16.7    | 2            | 1   | 3   | 10      |
| Easier to get to the ED                             | 2          | 2   | 3   | 14.3    | 3            | 2   | 3   | 20      |
| Affordable charges                                  | 2          | 2   | 3   | 16.7    | 3            | 2   | 4   | 32.1    |
| Language                                            | 3          | 2   | 3   | 20.3    | 3            | 2   | 4   | 28.6    |
| ED more child-friendly                              | 3          | 3   | 4   | 49.6    | 3            | 2   | 3   | 23.5    |
| Family tradition                                    | 3          | 2   | 3   | 18.9    | 3            | 3   | 4   | 47.8    |
| Not confident in taking care of an unwell child     | 3          | 2   | 4   | 42.5    | 4.5          | 4   | 5   | 87.1    |
| Has records in the ED                               | 4          | 3   | 4   | 61.4    | 4            | 4   | 5   | 86.5    |
| Condition worsens/persists                          | 3          | 2   | 4   | 44.6    | 5            | 4   | 5   | 93.6    |
| Not sure where 24-hour clinics are located          | 2          | 2   | 4   | 29.3    | 3            | 3   | 4   | 43.6    |
| For childcare leave                                 | 2          | 2   | 3   | 15.5    | 2            | 2   | 3   | 16.4    |
| Because of CPF/Medisave                             | 3          | 2   | 4   | 37.2    | 3            | 2   | 4   | 34.3    |

CPF: Central Provident Fund; ED: Emergency department; PCP: Primary care provider

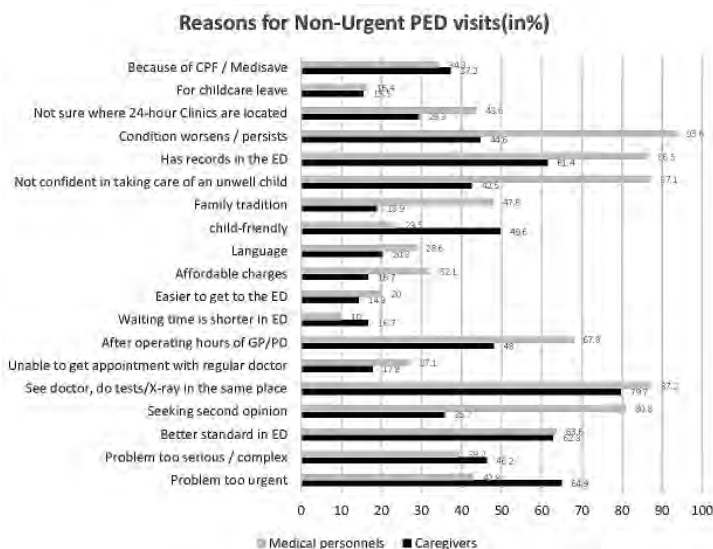


Fig. 1. Response given by medical personnel and caregivers on the reasons for non-urgent paediatric emergency department (PED) visits.

## Discussion

There is an apparent discrepancy in perception between ED personnel and caregivers with regard to reasons behind non-urgent PED visits.

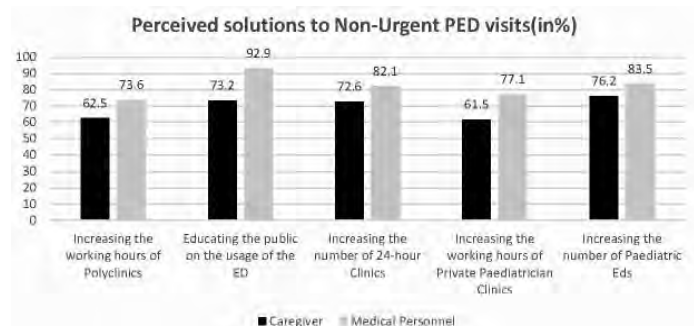


Fig. 2. Response given by medical personnel and caregivers on the perceived solutions to non-urgent paediatric emergency department (PED) visits.

A majority of the caregivers favoured the ED for its convenience and for its ability to function as a one-stop center where they could consult a doctor and have investigations performed. This brings forth the perception of the modern caregiver who values convenience and holistic one-stop care. A similarly high proportion of ED personnel, 87.2%, agreed with the above. Most PCPs have access to laboratory as well as radiology facilities and would be able to adequately diagnose and treat majority of problems presenting to them. There are currently ongoing educational and outreach programmes in place to educate caregivers on recognising illnesses that need the resources of the ED and those illnesses that can

be managed adequately in the primary health care setting.

Two-thirds (65%) of the caregivers visited the ED because their children's problems were deemed to be urgent, but only 43% of the medical personnel think this is a common reason for non-urgent PED visits. Almost half (42.5%) of the caregivers cited not being confident of taking care of unwell children as a reason to go to the ED. This highlights the role for caregiver training and education regarding the use of the ED as well as how to manage common paediatric medical problems and perceived emergencies.

A total of 61.4% of the caregivers agree that they go to the ED because their children have records in ED. Since public polyclinics in Singapore have shared access to patient records with public hospitals, this information should be made known to the public so that the misconception can be addressed.

## Conclusion

All in all, it adds to the growing body of evidence that there is a dire and urgent need to review and reshape how primary paediatric care should be delivered in Singapore. There is a need for a community paediatric model to be set up in Singapore to bridge this gap in delivering less urgent paediatric care holistically to the community with proper “right siting” of paediatric care—without maintaining, sustaining and expanding the need to have the community increasingly tap into the limited finite resources of tertiary centers. A comprehensive community paediatric model which is able to address the needs of the new age holistic care-seeking parent should and will be able to lift a significant burden of non-urgent cases from the tertiary centres.

There is a pressing need to develop a more inclusive and holistic paediatric model within our paediatric healthcare system to deliver a more balanced continuum of paediatric care from the primary paediatric sector to the tertiary sector in the hospitals. We need to create a more appropriate right siting of acute, low-medical acuity (i.e. Priority 3 paediatric patients) paediatric healthcare care for our community. This will involve enhancing the capabilities of the community paediatric PCP and creating a seamless system where care can be better shared between the community paediatric PCP and their colleagues in the tertiary hospitals.

Within this community paediatrics framework, we should also meaningfully enhance the point-of-care capabilities of PCP/private paediatricians not just in isolation but as a partnership model with the children's hospital so that patient-centered care can be better provided.

We should actively work with the Health Promotion Board and People's Association as well as leverage on IT to enhance information and education to better equip our young parents in dealing with common childhood medical problems. There should be a concerted effort in caregiver education, to teach them not just about the role of the ED, but what they can do at

home as a caregiver to manage simple non-urgent conditions, basic first aid steps that can be done at home before bringing the child to the doctor, when they may go to a PHP and what the red flags are for bringing the child to the ED.

In effect, we need to actively set up and develop a community paediatric model of healthcare delivery for Singapore for our immediate and long term future.

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Sashikumar Ganapathy,<sup>1</sup> MBBChBao, MRCPCh (UK), Soo Yen Lim,<sup>1</sup> MBBChBao, Jade PH Kua,<sup>1</sup> MBBS, MRCS (A&E) Edin, FAMS, Kee Chong Ng,<sup>1</sup> MBBS, MMed (Paeds), FAMS

<sup>1</sup>Department of Emergency Medicine, KK Women's and Children's Hospital, Singapore

Address for Correspondence: Dr Sashikumar Ganapathy, Department of Emergency Medicine, KK Women's and Children Hospital, 100 Bukit Timah Road, Singapore 229899.  
Email: sashikumar.ganapathy@kkh.com.sg