

BIODESIGN GLOBAL SOURCEBOOK: SG.03 SINGAPORE REIMBURSEMENT BASICS

Community support and individual responsibility are hallmarks of Singapore's healthcare system. The more Singaporeans consume beyond the basic care that public hospitals provide, the more Singaporeans are responsible to pay for healthcare services. These principles greatly affect how innovators are reimbursed for medical devices in the city-state.

To help inventors navigate possible reimbursement pathways for new medical devices, this chapter first explains how healthcare is distributed and financed in Singapore. It then discusses patient preferences, the Singapore government's reimbursement policies for medical devices, and alternative avenues for driving hospital and physician uptake of new devices. It also looks at how hospitals make purchasing decisions and negotiate prices. In addition, the chapter will provide background on the city-state's healthcare coding system. Knowledge of these issues will be critical for innovators to determine types of clinical needs to pursue and strategies for market entry.

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OBJECTIVES

- ✓ Understand the delivery and financing of healthcare services in Singapore.
- ✓ Gain insight into Singapore's reimbursement policies for medical devices.
- ✓ Develop familiarity with the codes used in Singapore's healthcare system.
- ✓ Understand how healthcare providers negotiate prices and make purchasing decisions for new devices.
- ✓ Explore alternative routes for device uptake and reimbursement.

SINGAPORE HEALTHCARE SYSTEM

After gaining independence from Britain in the 1960s, Singapore adopted the British healthcare delivery and financing model, under which the public sector mainly provided healthcare financed through general taxation. The private sector played a limited role. Since then, Singapore's healthcare system has evolved. Now both the public and private sectors offer healthcare services, with the government stressing personal responsibility in healthcare financing among citizens. This section will describe how healthcare is delivered and paid for in Singapore.

Innovators should note at the outset an important semantic difference in how these two issues are discussed in Singapore compared to the United States. Singapore uses the term *subvention* rather than *reimbursement*. Rather than giving hospitals money or reimbursing them for treatments already provided, the government in Singapore provides funding to public hospitals once a quarter. This funding is referred to as subvention. Public hospitals then use this block funding to provide *subsidies* to patients to cover a portion of patient bills.

Reimbursement refers to compensation or repayment for healthcare expenses *after* they are incurred or for healthcare services *after* they have been provided.

Subvention refers to the amount of funding that Singapore's Ministry of Health gives public hospitals once a quarter *before* services have been provided.

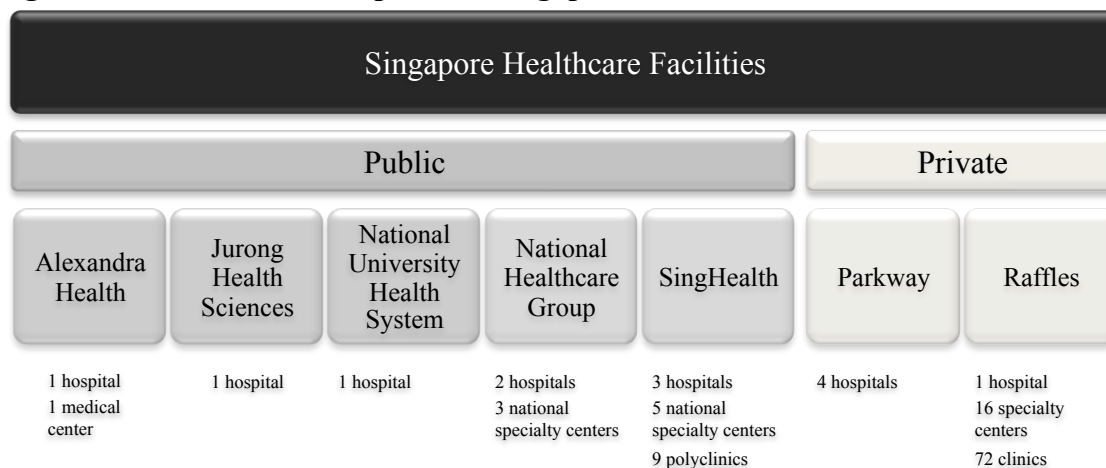
Healthcare Delivery

Public and private providers deliver healthcare in Singapore. Private medical practitioners' clinics and public outpatient polyclinics offer primary care, of which the private sector accounts for some 80 percent. Both public and private hospitals provide secondary and tertiary specialist care, with the private sector making up only 20 percent.¹ Figure 1 gives a brief overview of Singapore's main public and private healthcare delivery options. MOH manages public healthcare facilities and regulates private ones.

Primary care: basic care provided to patients for non-serious diseases

Secondary care: care provided by medical specialists who do not have first contact with patients (i.e., dermatologists, urologists, etc.)

Tertiary care: care provided to patients with complex disease conditions requiring practitioners with specialized clinical knowledge

Figure 1 Distribution of hospitals in Singapore²**Public Sector**

Because public hospitals account for such a large portion of secondary and tertiary care in Singapore, knowledge of the public healthcare system is particularly important for innovators. The government guarantees citizens access to affordable basic medical services by giving subvention funds to public healthcare providers. **Subvented hospitals**, also known as **restructured hospitals** are eligible to receive government subvention. These hospitals include MOH hospitals, Health Corporation of Singapore (HCS) restructured hospitals, and National University Hospital (NUH).³ Note that in Singapore, restructured hospitals refer to wholly government-owned or nonprofit institutions, where patients can receive subsidized medical treatment.

Public healthcare facilities in Singapore fall under five different clusters (see Figure 1). In the 1980s, the government began restructuring hospital services to give hospitals greater autonomy in an effort to increase efficiency, standards, and personalized service. The first hospital it granted more autonomy was NUH in 1985, the only hospital under the National University Health System. Another well-known public hospital in Singapore is Singapore General Hospital (SGH), which is one of three hospitals under Singapore Healthcare Services (SingHealth). SingHealth and the National Healthcare Group (NHG) offer vertically integrated primary, secondary, and tertiary care services. National specialty centers, which fall under SingHealth, include National Cancer Center of Singapore, National Dental Center, National Heart Center, National Neuroscience Institute, and Singapore National Eye Center.

Within Singapore's public hospitals, there are different ward options: A Class, B1 Class, B2 Class, and C Class (see Table 1). Patients in B2 and C Class wards are subsidized and cannot select their doctors, unlike patients in A and B1 Class wards. Public hospitals do *not* provide subsidies for patients who are:

- “Non-residents;
- Admitted due to industrial accidents;
- Admitted for non-basic healthcare services (e.g., liver transplant);
- Transferred from a private hospital or private wards of another restructured hospital;
- Referred to a specific doctor or wish to have their doctor of choice; or
- Being consulted or treated by their doctor of choice.”⁴

Table 1 Description of ward types⁵

Ward Type	General Description
A Class	Air-conditioned. Single or two beds with attached bathroom.
B1 Class	Air-conditioned. Four beds with attached bathroom.
B2 Class (subsidized patients)	Fan-ventilated. Six beds with shared bathroom facilities and amenities.
C Class (subsidized patients)	Fan-ventilated. Eight beds with shared bathroom facilities and amenities.

Private Sector

Private healthcare groups operate fifteen hospitals in Singapore. The two main private groups are Raffles Medical Group, which runs Raffles Hospital, and Parkway Holdings, which runs East Shore Hospital, Gleneagles Hospital, and Mount Elizabeth Hospital. Patients at private facilities can select their doctors. Whereas public hospitals provide patients round-the-clock surveillance, private hospitals do not since they do not have residents or interns. Table 2 highlights key differences between public and private care for patients in Singapore. These differences affect patient preferences (see Patient Preferences below.)

Table 2 Key differences in public and private healthcare options for patients

Public Healthcare		Private Healthcare
Subsidized patients <ul style="list-style-type: none"> • Lower cost • Round-the-clock surveillance of patients 	Unsubsidized patients <ul style="list-style-type: none"> • Amenities/comfort • Choice of doctor • Round-the-clock surveillance of patients 	Unsubsidized patients <ul style="list-style-type: none"> • Amenities/comfort • Choice of doctor • Tertiary care

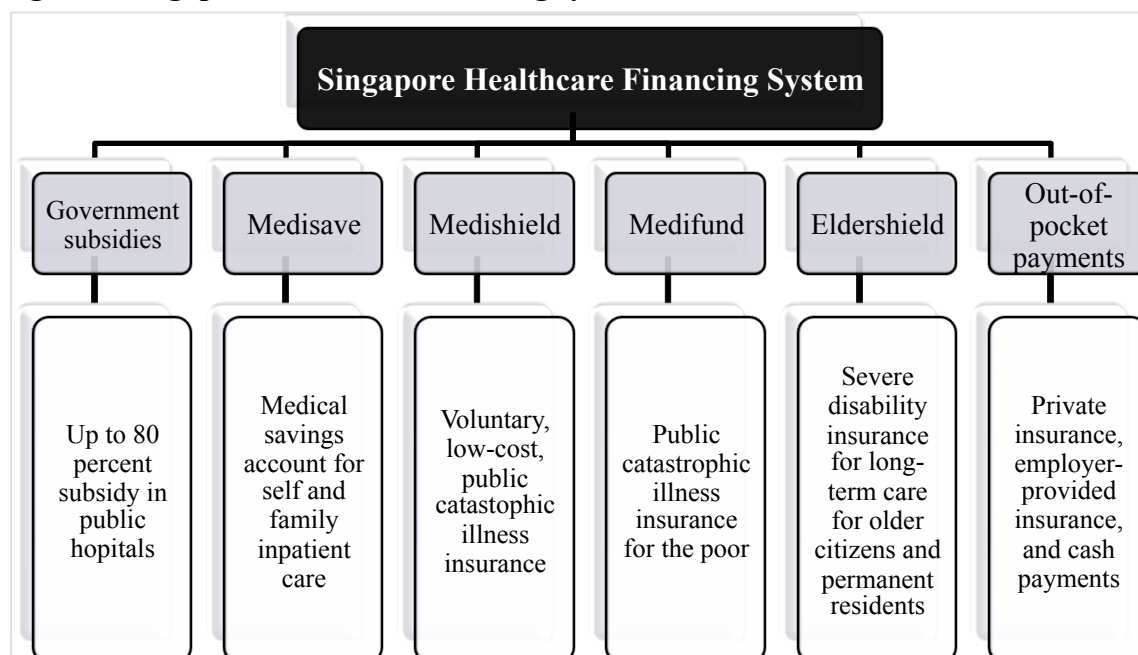
Healthcare Financing

Singapore finances healthcare through a combination of taxes, employee medical benefits, compulsory health savings, insurance, and out-of-pocket payments.⁶ Patients in Singapore are expected to co-pay part of their medical expenses and pay a larger difference if they demand service beyond the basic service provided at public hospitals. Therefore, innovators should gain an understanding of patients' willingness to pay for their device and explore options to increase government funding and subsidies for certain devices, such as MOH's Health Services Research Competitive Research Grant (see Alternative Reimbursement Routes below).

Singapore's Central Provident Fund (CPF) is a comprehensive social security savings plan, which encompasses healthcare, retirement, home ownership, family protection, and asset enhancement. Working Singaporeans and employers contribute monthly to three CPF accounts: an Ordinary Account for home purchases, education, and other items; a Special Account for retirement-related investments and expenses; and, of primary concern here, a Medisave Account for hospitalization expenses and approved

health insurance. Medisave is one of multiple tiers of financial protection in Singapore's healthcare system (see Figure 2).

Figure 2 Singapore healthcare financing system⁷



Tiers of financial protection include:

Heavy government subsidies

Public hospitals provide subsidies from the subvention funds they receive from MOH. Public hospitals generally pay for about 80 percent of bills for Class C patients and 65 percent for Class B2 patients. (They do not subsidize Class A or B1 patients, as described in Public Sector Delivery above). Take the following example: Madam Ng required knee replacement surgery and stayed in a Class C ward at Singapore General Hospital for eight days as a result. Her total bill for the procedure and hospital stay reached S\$17,000 (US\$1:S\$1.25), but Madam Ng only was responsible for paying S\$6,200 thanks to the government subsidy she received. She used money from her Medisave account and her Medishield insurance coverage (see below) to pay the outstanding balance.⁸ Subsidies are not available for patients in private hospitals.

Medisave

Singapore has introduced Medical Savings Accounts, known as Medisave, to reduce Singaporeans' reliance on government subsidies and increase personal responsibility for financing medical expenses. Medisave is a compulsory individual medical savings scheme that most Singaporeans use to pay for their share of medical treatments. The amount a patient may withdraw for hospitalizations depends on the category of spending according to the complexity of procedure. Refer to the Central Provident Fund website for amounts.⁹ MOH sets the withdrawal limits for Medisave. In 2010, Medisave covered:

- Daily ward charges;
- Doctor's attendance fees (maximum of S\$50);
- Surgical operation fees; and

- Inpatient charges for medical treatment, investigations, medicine, rehabilitative services, and medical supplies, as well as implants and prostheses introduced during surgery.

Singaporeans may also use Medisave to pay premiums for public medical insurance schemes like Medishield, subject to a withdrawal limit of S\$800 per policy per year and S\$1,150 for those aged 81 and older.¹⁰ If more coverage is desired, Medisave may be used to pay for enhancement plans from private insurers. In 2009, the average Medisave balance for members above age 65 was S\$9,369.¹¹

Medishield

Medishield is a voluntary, low-cost, public catastrophic medical insurance scheme to help Singaporeans meet medical expenses for major illnesses. Administered by the CPF Board, this low-cost insurance is designed to ease payment in Class B2 and C wards in restructured hospitals. Taking Madame Ng's knee replacement surgery again as an example, Medishield paid S\$4,423.03 of Madame Ng's post subsidy bill of S\$6,247.81. (She paid the remaining amount — S\$1,824.78 — with funds from her Medisave account.)¹² Patients in Class B1 and A wards, or in private hospitals, can also use Medishield, but a lower percentage of their hospital bill is covered.¹³ Medishield also covers certain outpatient treatments, such as kidney dialysis. If their Medishield coverage is insufficient, patients may use a portion of the savings in their Medisave account for additional private insurance to meet their expenses as long as they have not already exceeded their Medisave withdrawal limit. For examples of Medishield calculations illustrating different charges based on ward class, refer to the CPF website.¹⁴ Likewise, information on how Medishield claims are calculated can be found on the MOH website.¹⁵ Private and public hospitals use MOH's Mediclaim web e-service to submit Medisave and Medishield claims electronically.¹⁶

Medifund

Singaporeans who cannot pay their medical expenses despite Medisave, Medishield, and government subsidies are eligible for Medifund. This catastrophic illness insurance is funded from the interest earned on a capital sum of S\$1.7 billion (in FY 2009) to help Singaporeans with no other means to pay their medical bills.¹⁷

Eldershield

Eldershield automatically covers Singapore citizens and permanent residents at age 40 with Medisave accounts. It serves as an affordable severe disability insurance scheme to provide basic financial protection to cover out-of-pocket expenses for those who need long-term care. Whereas Medishield helps patients pay for their hospitalization costs, Eldershield serves to complement their Medishield and other medical insurance plans. It gives them monthly cash payments for a certain period of time depending on the Eldershield scheme they have chosen (S\$300 per month for 60 months maximum or S\$400 per month for 72 months maximum). Policyholders pay annual premiums until age 65 using Medisave or cash. They can claim benefits at any age until they die as long as they have paid their premiums. Three private insurers, Aviva, Great Eastern, and NTUIncome, manage Eldershield for MOH.¹⁸

Direct out-of-pocket payments

Direct out-of-pocket payments are those for which patients do not receive a subsidy and must pay the amount charged. Employer provided medical insurance or private

insurance may help cover unsubsidized costs in public hospitals and in the private sector, where patients are charged at hospitals and outpatient clinics on a fee-for-service basis.

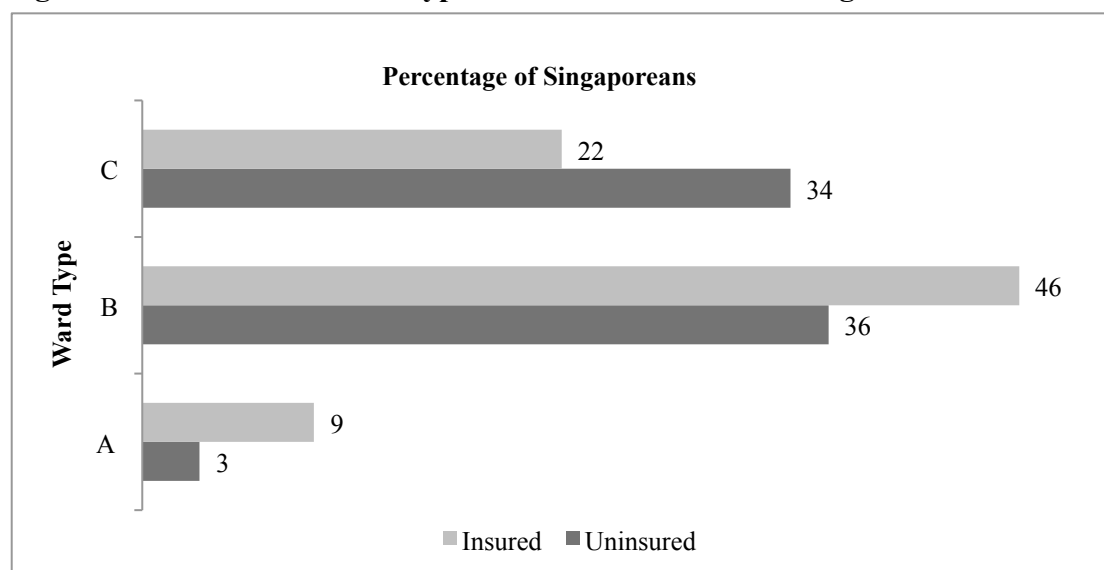
Private insurance: Singaporeans who desire additional benefits beyond those provided by Medishield may choose to purchase private insurance. Roughly 58 percent of Medishield holders have private insurance.¹⁹ They may use Medisave to purchase Integrated Shield Plans, which provide financial protection in addition to what Medishield provides. These plans offer supplementary benefits and coverage when policyholders opt for private hospitals or Class A or B1 wards in public hospitals. Medisave-approved Integrated Shield Plans include: NTUC Income's Incomeshield and Enhanced Incomeshield; American International Assurance International's Healthshield Gold; Great Eastern Life Assurance's Supremehealth and Supremehealth Plus; Aviva's Myshield; and Prudential Assurance's Prushield.

Employer-provided insurance: In addition to contributing to employees' CPF account as mentioned above, some employers offer private health insurance benefits to their staff. These employers tend to be big companies. (Small firms in Singapore are unlikely to provide private medical insurance benefits to employees.) There are three options for employer provided medical insurance: Portable Medical Benefits Scheme (PMBS), Transferable Medical Insurance Scheme (TMIS), and Provision of Shield plan (i.e., Medishield or Medisave-approved private integrated plan.)²⁰

Patient Preferences

The healthcare financing options available to patients inevitably affect the type of ward and hospital they choose. For instance, patients at public hospitals normally prefer Class A or B wards if they have insurance. Only patients who are uninsured prefer Class C wards (see Figure 3).

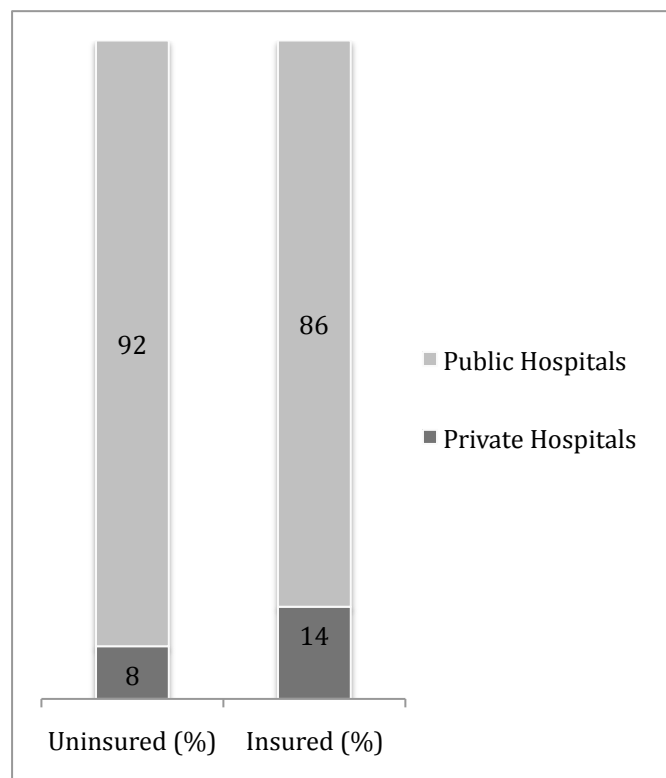
Figure 3 Preference for ward type based on insurance coverage²¹



That said, Singaporeans generally visit public hospitals more frequently than private, regardless if they have insurance or not (see **Figure 4**). This is often the case because

procedure costs at public hospitals are standardized and overall costs may still be significantly less than at private hospitals.

Figure 4 Percentage of Insured and Uninsured Singaporeans at public and private hospitals²²



Innovators need to understand patient preferences such as these to evaluate the clinical need for a new device. They then can assess the amount of government subsidy provided different patient populations, as well as the portion of a patient's bill reimbursable by Medishield for the patient's choice of hospital and ward class. They must also consider whether or not patients can afford the out-of-pocket expenses beyond the healthcare financing available to them. The answers to these questions can help innovators decide whether or not to proceed in developing a device used in procedures that require inpatient hospital care.²³ To gain a better understanding of patient preferences, innovators may want to interview relevant hospital staff.

DEVICE REIMBURSEMENT

Reimbursement Limits

Likewise, inventors should understand how much public sector hospitals can subsidize patients for medical device use specifically. This information will help them determine if private or public hospitals are their primary market, which will affect their strategies for getting hospitals and doctors to purchase their devices.

MOH only subsidizes implantable devices used for patients in Class C and B2 wards at public hospitals.²⁴ As of April 2011, the subsidy for an implant at a public hospital became 50 percent of the implant's cost, capped at S\$1,000.²⁵ MOH determined the new subsidy cap based on the fact that 90 percent of implants cost less than S\$2,000,

which means only 10 percent of patients need to pay more than 50 percent of the cost of their implants. The unsubsidized portion is paid by the patients' private insurance, from their Medisave account, or out of their own pocket. For example, Singapore General Hospital (SGH) replaced 1,500 knees in 2010, with implants costing between S\$2,500 to S\$3,500. Class C and B2 patients therefore had to pay S\$1,500 to S\$2,500 for the implant.

MOH subsidizes some non-implantable devices as well, thanks to funds set up by MOH to develop new capabilities and health services. Intuitive Surgical's Da Vinci robot used for minimally invasive surgery was first introduced to Singapore on a trial basis under a special development program (see Alternative Reimbursement Routes below). Even though a device may not be implantable and cost significantly more than the current standard of care, the government may choose to initially fund or subsidize the device if it improves a patient's quality of life. Innovators with devices such as the Da Vinci robot should explore alternative avenues of funding and support from MOH early in the concept design process.

Procedure Costs

An innovator must also consider how introducing a new device will affect procedure costs, as higher procedure costs may affect patient adoption of the device and a doctor's revenue. In addition to unsubsidized device costs, patients must also pay the unsubsidized portion of procedure costs from their Medisave account, private insurance, or out-of-pocket.

At National University Hospital, for instance, the following fees generally determine procedure costs: professional fees, facility fees, and total surgical fees. Surgeons do not collect any professional fees from subsidized patients but can from unsubsidized patients (i.e., Class A and B1 patients pay professional fees to surgeons). Instead, hospital departments pool professional fees from subsidized patients, and doctors accumulate points for each procedure. The points are then exchanged into a dollar amount based on a set formula determined by the hospital. The more subsidized patients that surgeons operate on, the more points surgeons earn. Surgeons are then awarded a greater portion of the professional fees pool at the end of the year. Innovators should note that if a procedure is performed more often on subsidized patients, then junior doctors are most likely to perform the procedure and are more likely to advocate for a device used in the procedure.

Furthermore, if a surgery is more complicated or takes longer than expected, doctors are able to add a surcharge to facility and professional fees. Senior doctors can command a surcharge of 200 percent for complicated procedures. For devices that extend typical procedure times, inventors should ask doctors whether there is a surcharge and how the surcharge would affect patient demand for the procedure.

Procedure time and cost changes will also affect hospital administration adoption, as hospital administrators are under constant pressure to increase efficiency by decreasing average length of stay, assigning manpower, and maintaining sufficient patient capacity at the hospital (see Subvention, Casemix, and Coding below).

Innovators should understand who and what drives the business, which may not be obvious. Do not assume that the doctors who have the technical expertise to operate a technology are the primary drivers. For example, the Department of Nuclear Medicine within SGH owns Positron Emission Tomography (PET) scanners and its doctors may know how to operate the scanners. However, doctors from the oncology department are the ones who actually drive a large percentage of this demand. Use of PET scans is also unsubsidized, such that patients pay for the entire scan.

Alternative Reimbursement Routes

Government Grants

Depending on the type of device they are developing, innovators may be able to seek funding and subsidies from the Singapore government. Take MOH's Health Services Research Competitive Research Grant (HSR CRG). Administered by the ministry's National Medical Research Council (NMRC), the program promotes research in health services and the transformation of results from that research into practical solutions and policies.²⁶ To date, a handful of studies involving medical devices have benefitted from this grant.

Innovators of devices that are not a cheaper option than existing technology, but significantly increase the effectiveness of treatment should consider seeking government funding under special programs that may be on offer at the time. Doing so could provide a foot in the door for their device at Singapore hospitals. Such funding may give inventors more time to figure out how to decrease the device's price or create enough public awareness that patients will be willing to pay for it.

For example, cochlear implants, which are electronic devices that provide a sense of sound to patients with severe hearing problems, received special funding.²⁷ During the funding period, the families of children using the implants did not have to pay for them: The usual 50 percent subsidy rate and cap for devices did not apply. When MOH cut the budget for the implants after funding for them ran out, families suddenly faced paying thousands of dollars for devices they considered essential for their children. Thanks to public outcry, mainstream funding now subsidizes the implants.

Likewise, Medtronic's deep brain stimulation (DBS) therapy for Parkinson's disease also initially received special government funding, after which MOH gave public hospitals block funds to subsidize the procedure. DBS is also an example of a treatment offered by public hospitals, rather than private ones, due to the procedure's relatively small market and high equipment costs.²⁸ Innovators can find more details about special funding programs on the MOH website (see Getting Started).

Health Technology Assessments

Innovators may need to include in their grant applications a Health Technology Assessment (HTA) report, which provides evidence that supports the proposed technology's use. HTA reports also provide useful information about new devices to patients; MOH and health professional associations; and hospital administrators and physicians responsible for technology management and procurement.²⁹ Innovators interested in doing an HTA in Singapore should approach public hospitals, such as SingHealth, which provides HTA services, including a "Handbook of Health Technology Assessment" on the SingHealth website (see Getting Started).

DEVICE NEGOTIATION AND PURCHASING

Singapore's fixed budget allocation for subsidizing devices and procedures, as well as the limits that MOH places on the amount of subsidy that public sector hospitals can provide patients, may sometimes give hospitals and doctors less incentives to use new medical technologies than in a country like the United States, which uses a fee-for-service system.³⁰ Innovators can improve the chances of getting health providers in Singapore to use their devices by understanding who makes purchasing decisions and how the price paid for a device is determined.

In Singapore, medical device companies tend to rely more on direct sales to hospitals than on selling their devices indirectly through distributors, like in larger markets. For some devices, direct negotiations between individual hospitals and either companies or their distributors determine prices. For example, prices for drug-eluting stents are negotiated directly between a doctor and the company's salesperson. For devices commonly used throughout Singapore, the salesperson may negotiate a purchasing agreement with a government hospital cluster.

The Group Procurement Office (GPO) of the SingHealth cluster currently decides on procurement for all common and high-impact items, including devices, for all SingHealth hospitals. Contrary to popular belief, however, it does not manage device procurement decisions for the entire public sector as it does for drugs. The National Healthcare Group has its own procurement office to handle these purchases. Meanwhile, each public hospital also has its own smaller GPO office for hospital-specific necessities and doctors to assist in making decisions for new technologies.

A committee of doctors at each procurement office meets about once a year to decide whether to use a new device. Hospitals select committee members who tend to be the main users or key players. Committee members consider the device's financial and clinical implications before seeking management approval for the purchase. The need for upper management approval depends on the institution and whether the purchase is for an entire hospital cluster or for an individual hospital. If the purchase is for a cluster, such as SingHealth, then the SingHealth CEO has final approval authority.

Inventors should note some factors that can go into a hospital's decision to purchase a new version of a device. Take the following example from SingHealth, in which four types of devices addressing the same need already exist. If an innovator creates a new competitive device in Singapore, then the SingHealth GPO will consider:

- Does the manufacturing facility conform to government regulations?
- Is the factory located in Singapore?
- Is the device certified for use?
- Does the device have a track record?

SingHealth's GPO may then decide to buy the new device on a trial basis, during which the device will account for roughly 10 percent to 20 percent of the total number of devices in this device category at SingHealth for about a year. The GPO will then assess the group's consumption of the device. It will also visit the medical device's manufacturing site to see if the site complies with government regulations. Because

the GPO is more comfortable purchasing devices from a distributor with which it has an established relationship, innovators should initially use known distributors to sell to hospitals, rather than investing in their own distribution network.

In private hospitals, doctors have more control over which devices are used. Although procurement offices in these hospitals generally make decisions on common items, such as syringes and major pieces of expensive equipment, the doctors decide on implants and similar devices. When selling to private hospitals, inventors may want to adjust their sales strategies to use more door-to-door salespeople.

Consignment

Innovators may have to sell their new devices to health providers on consignment, under which the provider holds a certain number of the devices and pays the innovator on a per use basis. Health providers often use consignment for high value devices, such as implants costing thousands of dollars. The government made a conscious effort to begin consignment in the late 1990s, when hospitals found it too expensive to purchase and store these items. Still, consignment is more common in private hospitals. In public hospitals, GPOs decide if items should be bought on consignment or in bulk. In private hospitals, either doctors or GPOs decide, depending on the item.

SUBVENTION, CASEMIX, AND CODING

Subvention or Block Funding

When contemplating device uptake strategies, innovators must take into account how subvention funds given to hospitals, and subvention coverage levels for procedures and devices addressing the same clinical need, will affect adoption by doctors and hospital administrators. MOH and hospitals, especially those in the public sector, face constant pressure to decrease waiting times, manage workloads, and increase efficiency by decreasing the average length of stay. These factors are tracked by the coding system, which is explained in this section.

In 2005, MOH once a quarter began providing public hospitals subvention funds, also known as block funding. As explained previously, hospitals receive subvention funding from MOH for patients using subsidized services (Class B2 and C). Public hospitals derive roughly half their total revenue from government subvention (and the other half from patients).³¹ MOH allows each hospital to determine how to use subvention funds on its own. This block fund covers resources such as manpower, consumable supplies (e.g., forceps, syringes, and cotton pads), operating theaters, and buildings. MOH's Healthcare Finance Division is responsible for subvention policy.

Prior to these reforms, MOH subvented hospitals on a fixed rate according to type of medical departments (e.g., gynecology, oncology, etc.) and length of patient stay (LOS), where longer LOS equated to more subvention for the hospital. Hospitals had little incentive to discharge patients earlier and allocate resources efficiently since they did not need to take into account the type, complexity, or severity of the patient's medical condition or the relative costs of the resources required.

Casemix

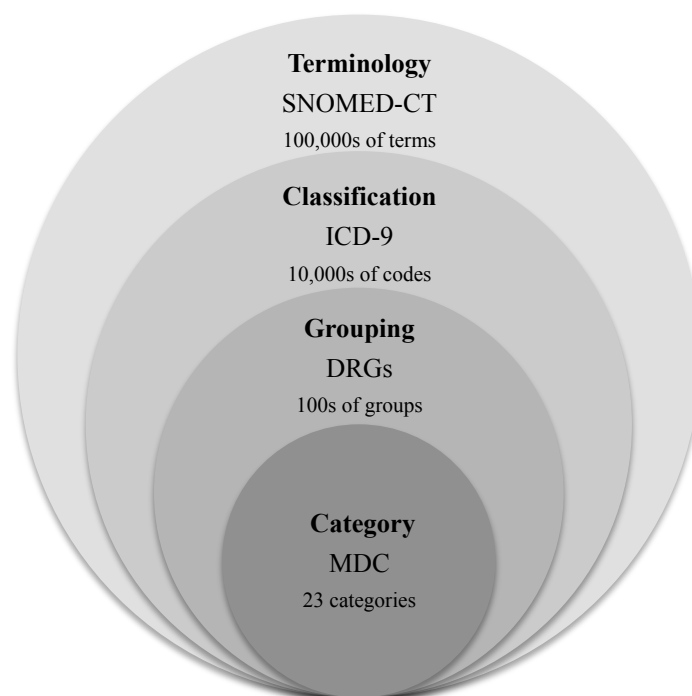
To determine the *next* block fund to provide a public hospital, MOH uses Casemix. Developed in the United States in the 1970s, Casemix refers to the type or mix of patients treated by a hospital or a unit, such as cancer patients or emergency patients. Countries use Casemix for a variety of purposes. These include measuring hospital performance to reward initiatives that increase efficiencies in hospitals and understanding the nature and complexity of healthcare delivery. Singapore uses it as a tool for funding surgery and inpatient services in public hospitals and national centers. The information from Casemix helps MOH decide a public hospital's next block fund by categorizing patients into groups using similar amounts of resources. Private hospitals do not use Casemix because they do not receive subvention funding.

Healthcare Coding System

Coding helps innovators see how a new procedure affects hospital revenue and adoption by hospital administrators in Singapore. Singapore classifies diseases according to: terminology (using SNOMED-CT codes), classification (using ICD codes), grouping (using DRG codes), and finally major diagnostic category (using MDC classification) as shown in Figure 5.

SNOMED-CT: Systematized Nomenclature of Medicine - Clinical Terms
ICD: International Classification of Diseases
DRG: Diagnosis Related Groups
MDC: Major Diagnostic Category

Figure 5 Classification of Diseases³²



Patient Grouping Classification – DRG codes

Many Casemix systems, including Singapore's, use a Diagnosis Related Group (DRG) coding system for classifying patient cases requiring similar resources into groups. MOH and public hospitals use DRG for inpatient and day surgeries to

compare the resources required. DRG is a broad classification system used for subvention funding purposes.

Innovators should understand which DRG codes map to procedures that employ competing pre-existing devices, and how their innovation may use more or fewer resources. For example, if the innovator's new device increases procedure time and manpower needs compared to existing options, then hospitals may be less likely to adopt it since it uses up more of their block funding from MOH. Moreover, a device that requires more hospital resources than competing devices may reduce the government's incentive to subsidize or fund the device under special programs, such as HSR CRG.

To better understand how an innovator might use DRG codes, consider a cardiac pacemaker implantation procedure. The procedure is referred to as DRG code R. 236. MOH and all public hospitals maintain a database for each code to track statistics, such as the number of patients who have undergone the procedure, length of stay, and cost of the procedure for each ward classification. For a cardiac pacemaker implantation (R. 236) in 2009, there were 371 patients and average length of stay was 6.6 days.³³ If a new cardiac pacemaker is likely to increase length of stay, then innovators should evaluate if public hospitals' uptake of the new device would decrease. Innovators can also use patient volume information under DRG R. 236 to help calculate the potential market size for a new cardiac pacemaker.

Singapore has adopted the Australian version of the DRG system, known as AR-DRG. Note that twenty countries, including Germany and New Zealand, purchased or were given license to use Australia's AR-DRG system between 2001-2011. Therefore, understanding the DRG coding system in Singapore should help innovators understand many other countries' coding systems as well.

Disease Classification – ICD codes

To classify diseases and a wide variety symptoms and complaints, Singapore and many other countries use International Classification of Diseases (ICD) codes (see Figure 5). The World Health Organization (WHO) owns the ICD coding system, and other jurisdictions use it by license agreement. Singapore uses ICD-9-CM and ICD-9. ICD-9-CM is the Clinical Modified version of ICD-9, which allows coders to further classify disease into ICD-9 subcodes. These subcodes, which public hospitals use for inpatient settings, are then mapped to the broader DRG codes for subvention purposes.

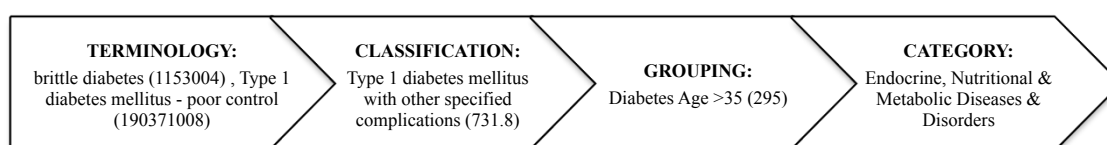
For outpatient procedures, the principal diagnosis for each outpatient case is translated into a three digit ICD-9 code for CPF (i.e., Medisave) and certain insurance claims, as patients can claim their CPF for certain outpatient medical procedures. Since outpatient settings are less resource intensive than inpatient settings, hospital coders do not map ICD codes to DRG codes for outpatient procedures. Coders within private hospitals code for CPF and insurance claims in ICD-9, based on principal diagnosis, secondary diagnosis, and surgical procedures for inpatient cases. Note that Singapore plans eventually to use ICD-10 AM coding, instead of ICD-9 CM coding.³⁴ ICD-10-AM refers to the Australian modification, which has also been adopted by New Zealand, Ireland, Turkey, and Slovenia.³⁵

Clinical Terminology Classification – SNOMED-CT

To classify specific clinical terms relating to a disease, Singapore and many other countries use SNODMED-CT codes. SNODMED-CT stands for Systematized Nomenclature of Medicine-Clinical Terms.

Figure 6 below illustrates how the coding system works for a patient with diabetes. Doctors determine the patient's specific disease of a certain SNOMED-CT terminology (brittle diabetes, Type 1 diabetes mellitus-poor control). They then give the medical problem a more generalized ICD classification (Type 1 diabetes with other specified complications) and DRG grouping (diabetes, age less than 35). This coding system is used for a variety of purposes in Singapore, including subvention, diagnosis reporting, cause of death reporting, and insurance claims.

Figure 6 Coding system for a diabetes patient³⁶



TOSP Code Set

Physicians use a different set of codes found in the Table of Surgical Procedures (TOSP) provided by MOH, which is available on the ministry's website.³⁷ The TOSP is a code set used for CPF and insurance claims to determine a patient's Medisave withdrawal limit. This is not an international classification standard, but more of a local classification used by Singaporean hospitals. For example, a kidney transplant from a live donor would be found under TOSP Table 5B with the Operation Code SG501Z. Innovators should research the physician codes listed in the TOSP to understand how much money would need to be withdrawn from a patient's Medisave account for a procedure as well as how much hospitals typically charge for that procedure (see Getting Started).

GETTING STARTED

Understand healthcare delivery and financing in Singapore

What to cover – Know the differences between public and private hospitals and ward types. Understand the various options for healthcare financing available to patients.

Where to look

- MOH website
 - “Schemes and Subsidies: Overview,”
http://www.moh.gov.sg/content/moh_web/home/costs_and_financing/schemes_subsidies.html

Research patient preferences

What to cover – Gain an understanding of patient preferences in order to better evaluate the clinical need for a new device.

Where to look – Visit relevant hospital departments to discuss patient preferences with hospital staff.

Understand the procedure location and procedure resources

What to cover – Research where the procedure employing your device will be performed (public and/or private hospitals or clinics)? If in a hospital, find out which medical department(s) the procedure will involve (e.g., Oncology, Gynecology, or Urology). Understand what equipment will be needed. Is the procedure typically performed on an inpatient or outpatient basis? If it is an inpatient procedure, what is the average length of stay (ALOS) for patients?

Where to look

- Research what is known about the innovation and what sort of equipment is needed. For example, if imaging equipment is needed during the procedure, does the targeted hospital department have it available?
 - Talk to the Group Purchasing Office and established distributors.
 - Research PubMed/UpToDate databases for existing clinical information.
- Visit relevant hospital departments to see if resources are available and if the procedure is typically done in private or public hospitals.
- For inpatient procedures, find the appropriate DRG code, and either approach hospital coders within the public hospitals or those in the coding team of MOH, who have access to data on the number of procedures done, the number of patients who go to each ward class, average length of stay, and procedure costs.

Research subsidization decisions

What to cover - For all procedures, research the physician codes listed in the MOH’s Table of Surgical Procedures (TOSP), which determines the amount patients may withdraw from their Medisave account as well as how much a hospital typically will charge for a procedure.

Where to look

- MOH website
 - “Schemes and Subsidies: Medisave: Withdrawal Limits,” which provides a table with the withdrawal limits.
http://www.moh.gov.sg/content/moh_web/home/costs_and_financing/schemes_subsidies/medisave/Withdrawal_Limits.html
- ICD-9, ICD-9CM, DRG lists
- Mediclaim: <https://www.mediclaim.moh.gov.sg>

Research government funding options

What to cover - Explore options to increase government funding and subsidies for devices, such as MOH’s Health Services Research Competitive Research Grant (HSR CRG), which is administered by the National Medical Research Council (NMRC). Innovators may need to include a Health Technology Assessment (HTA) report in their applications. Visit hospital website sections on HTA to understand the services they provide.

Where to look

- MOH website
 - “Fundings and Medical Research,” November 1, 2011,
http://www.moh.gov.sg/content/moh_web/home/Fundings_and_Medical_Research.html
 - “What is the Health Services Research Competitive Grant (HSR CRG)?” May 2, 2012,
http://www.nmrc.gov.sg/content/nmrc_internet/home/grant/compgrants/grantedHSR.html
- Hospital webpages on HTA
 - SingHealth, “Health Technology Assessments (HTA),”
<http://www.singhealth.com.sg/Research/HealthServicesResearch/services/HealthTechnologyAssessment/Pages/Home.aspx>
 - National Institute for Health and Clinical Excellence (NICE). Singapore’s MOH has an agreement with NICE in the United Kingdom to use data from the HTAs that NICE has performed.
<http://www.hta.ac.uk/project/index.asp>

Endnotes

- ¹ Keng Ho Pwee, "HTA in Singapore," *International Journal of Technology Assessment in Health Care*, 25: Supplement 1 (2009), p. 235.
- ² Ministry of Health (MOH), "Hospital Services," http://www.moh.gov.sg/content/moh_web/home/our_healthcare_system/Healthcare_Services/Hospitals.html (August 13, 2013); Parkway Pantai Ltd., "Our hospitals: Singapore," <http://www.parkwayhealth.com/hospitals/singapore/> (August 13, 2012); and Raffles Medical Group, "Overview," <http://www.rafflesmedicalgroup.com/about-us/overview.aspx> (August 13, 2012).
- ³ MOH, "Affordable Health Care," October 22, 1993, Affordable_Healthcare_Care.pdf, http://www.moh.gov.sg/content/moh_web/home/Publications/Reports/1993/affordable_healthcare.html (August 13, 2012).
- ⁴ National University Hospital (NUH), "Inpatient Charges," <http://www.nuh.com.sg/patients-and-visitors/appointments/hospital-charges/inpatient-charges.html> (August 13, 2012).
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- ⁶ Keng Ho Pwee, loc. cit.
- ⁷ MOH, "Schemes and Subsidies," http://www.moh.gov.sg/content/moh_web/home/costs_and_financing/schemes_subsidies.html (August 13, 2012).
- ⁸ Cheryl Tay, "Peace of Mind at a Low Cost," MOH website, http://www.moh.gov.sg/content/dam/moh_web/Publications/Educational_Resources/2011/0303/MOH2.pdf (August 13, 2012).
- ⁹ For details on claim limits for Medishield benefits, see Central Provident Fund Board, "Table A: Medishield Benefits," https://docs.google.com/viewer?a=v&q=cache:Xvfgn5xuTUoJ:ask-us.cpf.gov.sg/Home/Hybrid/themes/CPF/Uploads/Healthcare/MSH_Benefits%2520Table.pdf+http://ask-us.cpf.gov.sg/Home/Hybrid/themes/CPF/Uploads/Healthcare/MSH_Benefits%2520Table.pdf&hl=en&gl=us&pid=bl&srcid=ADGEESiId43ssvwqd9Sb9TWhPNVRf-qDzkbZWc_h5_drzl71oE9hfUcpcICX-DN2kpKdpaYzf566fROSE59PjIU6f3Ws_NY4k7iydkOpv-89esIk3MkLwnzyJVLjczSecrMeeLdHs9_j&sig=AHIEtbRPa06vYSTk9cj6rdupQwJ0G1Q5sQ (August 9, 2012).
- ¹⁰ MOH, "Schemes and Subsidies," op. cit.
- ¹¹ "Government should review subsidy for implants," *Straits Times Review*, July 16, 2011, p. A34.
- ¹² Tay, loc. cit.
- ¹³ Central Provident Fund, "Healthcare: List of Medical Institutions Participating in Medishield Scheme," http://ask-us.cpf.gov.sg/Home/Hybrid/themes/CPF/Uploads/Healthcare/MSH_Medical%20Institutions.pdf (August 13, 2012).
- ¹⁴ See Central Provident Fund, "Medishield Scheme," pp. 15-17, <http://mycpf.cpf.gov.sg/NR/rdonlyres/D083E278-EB14-4F76-B024-D1C114882FB8/0/mshnew.pdf> (August 13, 2012).
- ¹⁵ MOH, "Medifund," http://www.moh.gov.sg/content/moh_web/home/costs_and_financing/schemes_subsidies/Medifund.html (August 13, 2012).
- ¹⁶ MOH, "Overview," <https://www.medicclaim.moh.gov.sg/mmae/overview.aspxh> (August 13, 2012).
- ¹⁷ MOH, "Medifund," op. cit.
- ¹⁸ MOH, "Eldershield," http://www.moh.gov.sg/content/moh_web/home/costs_and_financing/schemes_subsidies/ElderShield.html (August 13, 2012).
- ¹⁹ "More Singaporeans covered by health insurance," *Channel News Asia*, October 26, 2010.
- ²⁰ Ministry of Manpower, "Portable Medical Benefits for Employees," <http://www.mom.gov.sg/employment-practices/medical-benefits/Pages/medical-benefits.aspx> (August 13, 2012).
- ²¹ Note that in Figure 3, some 25 percent of Singaporeans were unsure of their preference. Of these, 23 percent had insurance and 27 percent did not have insurance. See Veena Joshi and Jeremy Lim, "Health Insurance in Singapore: Who and Why," Health Service Research Network, Cost Effective Health Conference, October 2006, <http://www.singhealth.com.sg/research/healthservicesresearch/research/Publications/Pages/Home.aspx> (August 13, 2012).

²² Ibid.

²³ Biodesign often focuses on procedures and implantable devices. Since most cost-savings in innovative devices are from shortening/simplifying length of procedures or hospital costs, this discussion focuses on developing devices that require patient hospitalization, rather than on devices for outpatient care.

²⁴ Implantable devices normally require some degree of patient hospitalization. Patients in Class A and B1 wards receive no subsidy for their implants, but instead pay for them through insurance or out-of-pocket, just like patients in private hospitals.

²⁵ Previously, the government capped the subsidy at only S\$500 for all subsidized patients. See "Government should review subsidy for implants," loc. cit.

²⁶ MOH, "What is the Health Services Research Competitive Grant (HSR CRG)?" May 2, 2012, http://www.nmrc.gov.sg/content/nmrc_internet/home/grant/compgrants/grantedHSR.html (September 4, 2012).

²⁷ Cochlear implants were originally funded under MOH's Health Services Development Program (HSDP). HSDP no longer exists under that name. Grants are now potentially available under MOH's Health Services Research Competitive Research Grant (HSR CRG).

²⁸ MOH, "State of Health 2001: The Report of the Director of Medical Services," http://www.moh.gov.sg/mohcorp/uploadedfiles/Publications/Reports/2002/health_rpt.pdf (August 13, 2012).

²⁹ "The Handbook of Health Technology Assessment," Center for Health Services Research, Singapore Health Services (SingHealth), p.4, http://www.singhealth.com.sg/Research/HealthServicesResearch/OurServices/HealthTechnologyAssesment/Documents/HTA_Handbook_2011.pdf (August 13, 2012).

³⁰ Critics of fee-for-service systems contend that healthcare providers in those systems are incentivized to run more tests, do more procedures, and use more devices than always necessary since the more services they deliver, the more they earn.

³¹ Wong Chiang Yin, Singapore-Stanford Biodesign, lecture, September 15, 2011.

³² National University Health System (NUHS), presentation, February 18, 2011.

³³ MOH, "Cluster Data 2009," and "DRG Data from Public Sector for All Ward Classes in Year 2009."

³⁴ NUHS, presentation, op. cit.

³⁵ Australian Center for Clinical Terminology and Information (ACCTI), <http://chsd.uow.edu.au/accti/icd10.html> (February 23, 2011). According to the Center of Disease Control, ICD-10 will officially be used in the United States as of October 1, 2013, using the Clinical modification ICD-10-CM for diagnosis coding, and ICD-10-PCS, the procedure coding system, for inpatient hospital procedure coding. See Center of Disease Control, "International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10-CM). See <http://www.cdc.gov/nchs/icd/icd10cm.htm> (August 13, 2012).

³⁶ NUHS, presentation, op. cit.

³⁷ MOH, "Medisave: Withdrawal Limits," http://www.moh.gov.sg/content/moh_web/home/costs_and_financing/schemes_subsidies/medisave/Withdrawal_Limits.html (August 13, 2012).