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How should the government allocate resources in our healthcare system amidst competing needs such as those brought about by an ageing population, and Singaporeans' desire for high-quality medical care?

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(2498 Words)

Abstract

As Singapore's population continues to age, the competing health needs of elderly patients and the general population pose a crucial dilemma in allocating resources. With projected increases in health costs from innovative treatments and increased mortality rates of elderly patients, particularly for chronic diseases, the need for cost reductions with continued high-quality medical care is increasingly important.

As such, this essay emphasises a preventive approach to Singapore's historic reactive solutions. Whilst prevention often requires more oversight and management, such an approach would substitute potentially costly treatments with low-cost long-term health plans. Prevention is particularly suited to reducing the severity and incidence of predictable morbidities afflicting the elderly, allowing cost savings to be transferred to acute cases. In pursuit of prevention, this essay offers three main proposals.

Firstly, this essay will describe structural changes to Singapore's healthcare system in **Section 1**. By shifting away from centralised facilities, decentralisation could better suit the long-term management of chronic conditions dispersed across the nation, freeing up centralised facilities for acute cases. To support this management, Singapore's physician profile should shift towards generalist roles to better tend to chronic comorbidities.

In **Section 2**, this essay discusses changes to Singapore's reimbursement mechanisms, at all levels of healthcare, to better align financial and healthcare goals. This allows for self-correcting resource allocation, naturally incentivising all levels of healthcare to maximise health outcomes whilst minimising cost.

Lastly, **Section 3** discusses novel technologies and their role in reducing resource constraints in addressing Singapore's healthcare needs. Specifically, virtual medicine could

leverage emerging AI technology to automate long-term disease management, and to engage patients in managing their health. Whilse genomics and CGT products could improve health screening and treatment efficacy at reduced long-term costs.

Through prevention, resource strains could be minimised, easing resource allocation in meeting competing needs.

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Introduction

As Singapore marches towards a super-aged society[1] (Age Well SG), the import of balancing competing needs grows ever pertinent. The conflict between elderly care and high-quality treatment may initially seem disjointed, given elderly citizens also require high-quality medical care. However, whilst younger demographics often suffer from diverse, acute conditions; ageing individuals tend to instead develop chronic conditions. These differing morbidities pose varied healthcare needs, creating a complex dilemma when allocating healthcare resources. To maximise the attainment of MOH's[2] core values, whilst minimising healthcare costs, in response to Singapore's evolving morbidity profile[3], a shift to preventive healthcare must be fostered. Through prevention, incidence[4] and prevalence rates[5] could be reduced, allowing cost savings to be transferred to more urgent cases.

To effectively foster preventive healthcare, three main avenues could be pursued. Firstly, structural changes to Singapore's healthcare system, involving a shift to decentralised treatment and a focus on generalism could be furthered to better meet the evolving morbidity profile of an ageing population without sacrificing excellent medical care. Secondly, adjustments to various reimbursement mechanisms could more effectively promote prevention whilst minimising oversight and addressing underserved needs. Lastly, investment in novel solutions, like Telemedicine, CGT[6] and Genomics could improve dynamic efficiency, ensuring limited resources are best applied to meet Singapore's future competing needs at a reduced cost.

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[1] Singapore is projected to attain 'super aged' status in 2026, defined as >21% of its population being over 65. (Age Well SG)
[2] (1) medical excellence (2) the promotion of good health (3) the reduction of illness (4) access to good and affordable healthcare for all Singaporeans, appropriate to their needs. (MOH, *August 2021*)
[3] Marked by
[4] Incidence rate: the number of new cases of a disease divided by the number of persons at risk for the disease (State of New York)
[5] Prevalence rate: the total number of cases of a disease existing in a population divided by the total population (State of New York)
[6] Cell and Gene Therapies

Section 1: Structural Changes

Section 1.1: Decentralisation

Our established healthcare models of centralised treatment centres in large, sprawling hospitals have historically benefitted Singaporeans through reduced costs[7], improved resource allocation, improved data collection, standardisation[8], and the integration of healthcare services[9].

However, these benefits may be outdated amidst the growing climate of an ageing Singapore. Whilst the centralisation of traditional specialties remains ever important in the treatment of complex, acute conditions, and for the quarantining and treatment of infectious diseases; The advent of chronic conditions and long-term care may benefit from a shift to the decentralisation of treatment centres. Such a move ensures the continued high-quality treatment of acute conditions at centralised treatment facilities by off-loading the burden of monitoring and treating chronic conditions to decentralised locations.

This belief is supported by MOH's Healthier SG scheme launched in 2023, which promotes the shift to decentralised healthcare. In particular, the 'One Singaporean, One Doctor' (OSOD) sub-scheme[10] acts as a cornerstone for this transition, given the reliance on trust and rapport for preventive programmes[11].

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[7] Through various economies of scale
[8] Ensuring equitable access and consistent quality of care
[9] Such as the employment of multidisciplinary teams (MDTs) in the treatment of complex conditions whereby various specialists could efficiently collaborate under a shared facility.
[10] Which focuses on developing a personal connection between each Singaporean and a doctor.
[11] Given the increased resistance in following through with lifestyle changes like dieting and exercise, as compared to simply taking daily medications, healthcare workers need to be more persuasive.

However, for this scheme to be effective, further integration is needed between clinics and the greater healthcare ecosystem[12]. Efforts have been taken to deepen this integration, including grants for information technology upgrades[13] and annual service fees[14] (Abdullah). However, given Singapore's limited public FP[15] network, found primarily within its 23 polyclinics, the OSOD Scheme would rely heavily on the 1,800 private GP[16] clinics which meet about 80% of the total primary care demand (MOH, *October 2023*). In the first month of recruitment, only 712 out of the 1,200 CHAS[17] clinics have enrolled, suggesting moderate adoption (Abdullah).

Currently, most GPs operate individually, lacking team-based solutions. However, prevention heavily relies on a team-based care approach, utilising nurses, care coordinators and pharmacists besides just FPs (MOH, *September 2022*). Whilst this team-based model is easily implemented in centralised polyclinics, implementation in GP circles remains poor, with few CHCs[18] and FMCs[19] established to date. Currently, the leading proposal involves increasing the scope of GP responsibilities; however, with decades of experience in reactive healthcare, the transition to prevention, even with the introduction of Healthier SG's 12 care protocols[20] (MOH, *September 2022*), would be difficult, requiring ample retraining and increased financial incentives. This will be further explored in *Section 1.2: Generalism* and *Section 2: Reimbursement Mechanisms* respectively.

[12] In reference to platforms for social prescription, like activities offered at AACs; dietitians; centralised facilities, like hospitals; academia, such as healthcare research firms; and private-public collaborations.
[13] Specifically to integrate private clinics' IT systems with the National Electronic Health Record (NEHR) system
[14] Acting as capitation funding to encourage GPs to focus on prevention, aiding integration through the implicit financial incentive to seek out public-sector social prescriptions, like activities offered in Active Ageing Centres (AACs).
[15] Family Physician
[16] General Practitioner
[17] Community Health Assist Scheme
[18] Community Health Centres (CHCs) work with General Practitioners (GPs) to support the care of chronic conditions (AIC), through the provision of ancillary services. Currently, only 6 permanent CHCs and 2 mobile CHCs support a portion of the 1,800 GPs (AIC; Vasanwala 36), and no single CHC offers a full range of services (Vasanwala 36).
[19] Family Medicine Clinics (FMCs) are private one-stop medical clinics in the community with enhanced facilities and capabilities. Only 3 are operated under the NUHS cluster (NUHS).
[20] Aimed to guide family doctors on providing screening and vaccination and managing key chronic conditions in relation to the increased focus on preventive healthcare.

Section 1.2: Generalism

As alluded to in the above discussion of ‘decentralisation’, a shift towards community-based treatment would rely heavily on a strong network of generalist roles[21] which may be better-suited[22] for the chronic, multimorbidities many elderly face. At present, the most populous specialties[23] (MOHH) may cater more to younger demographics or acute conditions, such as paediatrics and orthopaedics, respectively. These niche specialisations are less-applicable given the breadth of generalised knowledge needed in managing multimorbidities and administering holistic treatment[24].

Currently, Singapore faces a shortage of generalists amidst an overabundance of specialist doctors. This partly came as a result of a previous focus[25] (Ng, *October 2017*) on becoming a hub for medical tourism, which benefited more from increased specialisation[26]. Additionally, the prestige associated with specialisation further exacerbates generalist shortages. In sum, these factors lead to newly-trained specialists struggling to find work within their speciality, and instead accepting roles as general practitioners (GPs)[27] (Ng, *October 2017*). If instead, these specialists started with family medicine in residency, they may be much more effective in their capacity as FPs.

To increase the supply and abilities of generalists in Singapore’s healthcare system, the inefficiencies of this system must be addressed. Two main proposals could be pursued.

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[21] Beyond family physicians, this includes geriatrics, internal medicine and palliative care.
[22] Broader scope of generalists allows better polypharmacy management, comorbidity management, efficiency and cost-effectiveness through reduced fragmentation of care, and better continuity of care through deeper relationships. Generalists also tend to focus on prevention and holistic care.
[23] Residents in seven highly-subscribed specialties, namely Dermatology, Paediatric Medicine, Ophthalmology, Orthopaedic Surgery, Otorhinolaryngology, Obstetrics & Gynaecology, and Plastic Surgery require copayments due to their popularity and high attrition rates. (MOHH)
[24] A hallmark of prevention given its prohylactic approach over reactive treatment.
[25] Through the fast-track residency system modelled after America’s residency programme, shortening residencies by 1-2 years (Ng)
[26] This goal has since been relinquished given adequate alternative drivers for economic growth and the urgent need to pivot Singapore’s healthcare focus to address its ageing population
[27] “One result of this is that some find themselves without a job in their preferred specialty” - Senior Minister of State for Health Chee Hong Tat

Firstly, further generalist training is needed, not only in medical school curricula but amongst current GPs and transitioning specialists[28]. In line with Healthier SG, local medical schools have revamped their curricula; however, whilst effort is taken to emphasise prevention[29] and increased generalist responsibilities, most changes pertain to AI skills and digital literacy. Whilst digital skills are important, more emphasis could be placed on fostering underdeveloped[30] skills in motivational interviewing, counselling, and more[31], to successfully encourage healthy behaviours and connect patients to appropriate community partners (Foo et al.). Meanwhile, transitioning specialists and existing GPs may benefit from upskilling programmes under a SkillsFuture framework, to foster development without starting anew; this may also reduce long-term retraining costs, whilst minimising supply disruptions due to SkillsFuture's digital, part-time nature (Ng, *October 2017*; Foo et al.).

Secondly, family medicine could be formalised as a specialty under the Specialty Accreditation Board (SAB)[32] to avoid being perceived as less prestigious[33], whilst simultaneously offering a further incentive for GPs to upskill and become proper FPs. This process reflects the formalisation of family medicine in the US, under the ABFM[34], which succeeded in its similar aim to increase the intake of family medicine practitioners; The ABFM practically eliminated GPs, with most GPs attending the 3-year residency to become

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[28] In reference to specialists unable to secure jobs in their specialty, as raised by Senior Minister Chee Hong Tat

[29] New Interdisciplinary common module in the Yong Loo Lin School of Medicine, aligns with Healthier SG's team-based approach, whilst the school also fosters social prescribing skills as part of curricula (NUS). LKCMedicine also aimed to align with Healthier SG, incorporating community health partners in teaching (NTU).

[30] Many doctors currently aren't able to deliver the best social prescriptions due to a lack of awareness on community programs available; and aren't ready to take on increased responsibilities (Foo et al.)

[31] Such as greater emphasis on social prescribing, preventive monitoring, administrative requirements and more complex drug inventory management; to a greater extent than in the revised curricula.

[32] Currently the SAB only recognises 35 specialties, and 10 sub-specialties, including many generalist specialties pertaining to managing an ageing population, like geriatric medicine, palliative medicine, internal medicine, amongst others; though notably, not family medicine.

[33] Thus mitigating the oversupply of specialists and the concern of specialists misspending their time in residency only to work as GPs.

[34] American Board of Family Medicine; America's "Boards" differ from Singapore's, and more closely resemble the SAB.

generalists[35] (Dalen et al. 766-768). Singapore already has both the FPAB and CFPS[36], and a Family Practice Register, requiring post-graduate training for membership[37] (CFPS). However, despite the existence of many of these programmes, only 30% of primary-care physicians participated in formal training prior to 2011 (FPAB). Thus proper formalisation in the prestigious SAB, with further promotion of its accreditation and importance throughout society[38], could encourage enrollment and improve FP supply.

However, beyond a shift towards generalism and decentralisation, healthcare resources must be reorganised not just through organisational structure and manpower allocations, but through financial mechanisms too.

[35] Specifically FPs, general internists or general paediatricians
[36] Family Physicians Accreditation Board (FPAB) and College of Family Physicians Singapore (CFPS) respectively.
[37] The Graduate Diploma in Family Medicine is a basic requirement to be a family physician and to be registered in the Family Practice Register (FPR) (CFPS); The Master of Medicine in Family Medicine (MMed (FM)) also exists for further upskilling.
[38] Such that beyond reconditioning current medical students and transitioning doctors, incoming students, parents, and wider society would hold FPs in higher esteem.

Section 2: Reimbursement Mechanisms

In line with established business and economic theory, monetary changes are often the greatest tools in driving optimised change. Funding model reforms give room for self-adjusting, and self-governing mechanisms to take root, incentivising innovation to a greater extent than strict top-down regulatory changes or direct subsidies.

To further incentivise preventive healthcare, and ensure the healthcare needs of both the elderly and the general population are of high standard, it's crucial to alter Singapore's reimbursement mechanisms (RM). Traditionally, Singapore employed a form of fee-for-service funding model, under a bundled-payment scheme[39]; improving disease-level operational efficiency. However, such a model raised concerns over the incentivisation of quantity over quality[40], and the discouragement of preventive care.

With Singapore's recent shift to a capitation model[41], these shortcomings have been addressed. Under capitation, HBHS[42] are greatly incentivised over LBHS[43] (Matchar et al.). This shift capitalises on Singapore's small size, and dominance of the public sector[44], to incentivise prevention[45], efficiency and coordination, through the alignment of financial and health goals. However, whilst MOH assures its capitation policy is designed with a slight

[39] where providers are paid a one-time fee for a patient's episode of care rather than reimbursing for each treatment, test, or procedure
[40] Healthcare providers are paid only per episode of treatment, as such, poor treatment which allows for relapses and thus further treatment may even be financially incentivised.
[41] Whereby healthcare providers are assigned a population base, and are paid a predetermined amount per resident under their charge
[42] high-benefit healthcare services (Matchar et al.): referring to services that have high impact on the listed measures of health.
[43] Low-benefit healthcare services (Matchar et al.): referring to services that have limited or no impact on the listed measures of health, such as back surgery for acute low back pain in the absence of a neurological deficit.
[44] Small size results in less oversight and benefits from relative ease of implementation, public sector dominance is beneficial as cavitation does not apply to private healthcare (FFS only).
[45] As HHBS, through prevention and cures, would result in more future funding through savings on reduced mortality and expenditure on further treatments.

budgetary increase[46], the risk of undertreatment and the complexity of risk-adjustment[47] poses a significant administrative hurdle for MOH (Matchar et al.).

To alleviate these shortcomings, a hybrid system could be used. This is partially the case, with resources like the Rare Disease Fund (RDF)[48], covering some low-demand, high-cost HBHS that are disincentivised under capitation[49]. A hybrid system could employ reduced value-based bundled-payments to 'subsidise' costly treatments on top of the base capitation fund, mitigating undertreatment[50]. More measures of risk beyond age[51] could address the complexity of risk-adjustment, with fund-allocation per risk-group calculated based on extrapolated historical data on mean service costs. Most importantly, funding must be continually adjusted based on measured KPIs[52], to ensure efficacy; notably, arguments have been raised over insufficient GP-level capitation funding, resulting in low GP enrolment rates in Healthier SG (Foo et al.). Increasing funding may be necessary to address competing needs and enrollment targets, with funding constraints being offset by cost savings from programme efficacy and lowered morbidity rates.

Moreover, remuneration for research grants and purchasing agreements[53] could also be optimised through further reliance on hybrid risk-sharing agreements[54] (RSAs). These RSAs could include aspects of outcome-based funding such as the release of funding in stages based on key milestones, or performance incentives for surpassing milestones; and

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[46] with further age-adjusted increases (Ong, *May 2023*)
[47] Beyond age. Currently cluster-level capitation is presented as being on age-adjusted, whilst GP-level capitation considers more risk factors. (Ong, *May 2023*)
[48] A fund dedicated to rare diseases with costly treatments. Operates on a 3-to-1 donation matching scheme by the Government, with fund managers to grow the fund over time.
[49] as funds could be used for cheaper, preventive HBHS for more patients
[50] This is the case only for GP-level capitation (MOH, *September 2022*)
[51] Such as socioeconomic factors, gender, geographical region, clinical diagnoses, pharmaceutical records as employed in Netherland's capitation model (Yoong et al.); GP-based capitation funding under Healthier SG does consider factors beyond age, though not as extensive as Netherland's, nor does this apply to the wider capitation model for the three healthcare clusters (MOH, *September 2022*).
[52] Currently, MOH has set out a list of short, medium and long term indicators, from rate of resident and GP enrolment to healthcare costs. (MOH, *September 2022*)
[53] For medicine and medical equipment.
[54] Merging both Outcome-based RSAs and Financial-based RSAs

financial-based funding features like reimbursement clauses and cost-sharing mechanisms[55]. This could allow for more open-handed research grants and experimental treatment options for patients, promoting innovation whilst improving treatment outcomes without significant budgetary sacrifice[56].

Lastly, whilst this essay primarily focuses on allocating resources amidst the competing needs of an ageing population and younger demographics, citizens suffering from rare diseases should not be forsaken. As such, Singapore's financial approach to rare disease treatment could take inspiration from the UK's[57] NHS[58] Specialised Services and NICE[59]. Currently, Singapore's RDF relies on donations and investment returns to fund seven treatments for five conditions[60] (Ong, *May 2023*). The fund was forecasted to expend up to $4.8 million[61] in 2023 (Parliament of Singapore), with MOH expending $18 billion in total (MOF), paling in comparison to the $39 billion[62] forecasted FY22/23 expenditure by the NHS Specialised Services[63]. The NHS funds rare disease treatment through taxation, providing treatments like Zolgensma ($3 million[64]) under the public healthcare system; treatments not publicly provided in Singapore[65] (Ng et al.). To resolve this inadequacy, the government could provide a minimum annual RDF contribution regardless of donations[66], improve the

[55] Particularly for unexpected expenses or cost overruns
[56] Mainly due to purchase agreements under hybrid RSAs.
[57] United Kingdom
[58] National Health Services - the publicly funded healthcare system in England.
[59] National Institute for Health and Care Excellence
[60] As of 22 November 2023 (date of most recent publication on treatments covered by RDF)
[61] Given (1) at end-FY22, the size of RDF is $143 million (2) For FY23, the RDF's projected investment income is $4.8 million. (3) Projected investment income is intended to adequately support all known patients requiring that treatment to ensure financial sustainability. (Parliament of Singapore)
[62] Converted to SGD from GBP at 0.591704$/£ as of 11:31:18 pm, 10 August 2024 (SGT)
[63] N.B. the total budget for NHS during FY2023 was $306 billion (The King's Fund), converted to SGD from GBP at 0.591704$/£
[64] Price varies across sources, $3 million is cited as the listed price by the NHS, converted to SGD from GBP at 0.591704$/£.
[65] In Singapore, SMA patients needing Zolgensma rely on charitable contributions on private crowdfunding platforms, due to inadequate government help (Ng et al.). Such methods rely on the patient's popularity to garner donations and afford treatment. This is a failure of MOH's core value of 'access to good and affordable healthcare for all Singaporeans' (MOH, *August 2021*)
[66] This is the weakest proposal, and would be funded through taxation as is the case with the NHS. Whilst increased taxation is unpopular, and reallocation of government spending may be difficult, however, it shall still be proposed as it is undeniable that the NHS, and its reliance on taxation has allowed it to attain 'medical excellence' for 'all [citizens]' whilst Singapore fails to do so for certain rare disease groups.

coverage of MediShield Life[67], and foster more risk-sharing purchase agreements[68] for lower drug prices.

Section 3: Novel Technologies

Section 3.1: Telemedicine

The introduction of virtual healthcare[69] and telemedicine[70] could further reduce the strain on Singapore's healthcare resources, allowing us to more comfortably balance competing needs. Virtual healthcare leverages Singapore's 2018 introduction of 5G data[71] and the extant WirelessSG network to automate and reduce health management costs. Given the low cost and oversight involved in implementing virtual healthcare solutions, crucial resources like physicians could be employed in more urgent issues.

Telemedicine is particularly beneficial in Singapore's healthcare climate, allowing immunocompromised elderly patients to seek consultations without being exposed to infectious patients in waiting rooms. Moreover, given its convenience, elderly patients are also incentivised to seek consultations more frequently, facilitating prevention over treatment.

In South Korea, Naver's recently introduced CLOVA CareCall system[72], now adopted in over 70 local governments, with over 90% user satisfaction, provides the elderly with telemonitoring services and emotional care. Such technologies have great promise in

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[67] To include expensive treatments, including CGT products like Zolgensma. This is the most suitable platform to address the issue, given the nature of insurance in addressing rare, unforeseen circumstances. Improving coverage to include Zolgensma is currently in discussion (Lee).
[68] Beyond the functions described earlier, this could also be modelled after the NHS's Patient Access Scheme, which utilises simple discounts in addition to risk-sharing factors.
[69] an overarching term encompassing remote services across the healthcare industry, including telemedicine.
[70] the remote diagnosis and treatment of patients by means of telecommunications technology.
[71] Singtel's network coverage alone surpasses 95% as of 2022 (Singtel)
[72] AI teleconsultation and telemonitoring system, through virtual automated surveys and chatbot functions, with growing sophistication to mimic natural conversation.

curbing Singapore's loneliness epidemic[73], given their potential for any-time use; simultaneously, human capital could be relieved from the timely process of health monitoring, without sacrificing improvements in prevention[74]. Such a system could also be used for social prescriptions, performing similar functions to Healthy 365[75].

However, strong headwinds inhibit the adoption of telemedicine programmes in Singapore. teleconsultations face issues of data inaccuracy (MOH, *HealthWatch*). Misdiagnoses from inadequate data could undermine healthcare efforts. Moreover, large volumes of elderly seeking teleconsultations for conditions requiring physical visits may even exacerbate healthcare strain. Simultaneously, many elderly lack digital literacy skills, and can't use telemedicine effectively. Lastly, as of 2022, 11% of seniors still lack the smartphones necessary for modern telemedicine solutions (Wong).

Beyond headwinds in adoption, existing platforms like Healthy 365 could also be further developed to foster engagement through gamification[76] and log-in incentives. Engagement with the platform acts as a lever for other programmes[77], boosting the efficacy of in-platform health initiative promotions[78]. Gamification could include healthpoint or daily steps leaderboards (Cigdem et al.); or collaborations with "healthy games" like Pokemon Go[79], with healthpoints awarded for in-game progress (Wang 100411). Moreover, Log-in incentives[80]

[73] 46.2% of Singaporeans aged 60 years and older reported being lonely in 2015 (Malhotra et al. 1-11). CLOVA could work in concert with other programmes like communal activities in AACs.
[74] Through more frequent monitoring with CLOVA-like systems
[75] a mobile application that helps residents discover and access healthy lifestyle offerings, whilst providing tools and programmes to reach their health goals.
[76] The gamification of a daily journal for mental health led to an 11.2% increase in usage ($F_{2,12}$=6.341; P=0.002) (Taylor et al. e11683)
[77] Whilst Healthy 365 promotes LumiHealth, which gamifies health, and promotes other programmes, LumiHealth is limited to Apple platforms and is less extensive than Healthy 365. The consolidation of both platforms under Healthy 365 would centralise reward systems (healthpoints and coins), improve accessibility beyond Apple (most used by high-income individuals least in need of preventive healthcare), leverage past promotion and widespread adoption of Healthy 365.
[78] Such as Screen-for-Life, nearby AAC activities, "Eat, Drink, Shop Healthy Challenge 2024", National Steps Challenge, etc.
[79] Known to *"[have] a very positive effect on physical activity… and mental health"* by encouraging steps and outdoor exercise.
[80] Such as streaks, a publicly shared 'score' of consecutive daily log-ins to encourage competition and pride; or log-in rewards, such as 1 free healthpoints for the first log-in of the day, resetting daily(equivalent to $0.0067, 1 minute of moderate to vigorous workout, or 500 steps) (Synapxe)

could encourage daily-use, habitualizing platform visitation with small dopamine boosts (Schultz e2316658121). Through these systems, Healthy 365 usage could be increased, bolstering exposure to promoted programmes[81] whilst encouraging self-monitoring[82] and healthy living. In turn, participation in such programmes[83] could offer healthpoints too[84].

To improve, AAC digital learning workshops could offer ultra-budget smartphones[85] for the remaining elderly[86], preconfigured for their needs[87]; whilst elderly volunteering efforts could be further promoted[88] over less pertinent issues to boost telemedicine[89] education and adoption.

[81] With particular reference to the activities listed in the ‘programmes’ and ‘events’ tab of the Healthy 365 app.
[82] Which could be shared to and monitored under MOH by accessing user’s Healthy 365’s data.
[83] Such as the ‘Zumba Gold - A6877’ event, a live active - active ageing (group exercise) offered under the Healthy 365 app.
[84] Not all elderly wear compatible fitness trackers, but many enrol in Healthy 365 events, as such awarding healthpoints based on participation (from the same daily quota of the national steps challenge) especially for low heart rate activities like Yoga, may be more optimal.
[85] Given seniors tend to only require call and SMS functions, considering the proposal’s low technical requirements, “ultra-budget” devices like the SHIVANSH LYF C459 ($40SGD) could be offered (Gadgets 360) to minimise cost. Such low-spec devices would also discourage the abuse of the device collection programme.
[86] In reference to the remaining 11% lacking smartphones.
[87] Such as through default languages being their mother tongue, larger font sizes, scam protection software, pre-installed health apps, and simplified UI elements.
[88] Such as through bonus VIA hours, or discounted VIA hour requirements, in collaboration with MOE.
[89] Including when to use physical consultations over teleconsultations.

Section 3.2: CGT and Genomics

Singapore could also consider further investment into CGT, leveraging[90] genomics, bringing promising prospects for both high-quality treatment and preventive medicine.

Currently, Singapore's clinical genomics efforts lie primarily in facilities[91] like MDL[92]. The lab offers reactive single-gene pharmacogenetic and small-panel tests, which provides utility in personalised medicine through individualised drug selection and dosing, ensuring improved efficacy over generalised prescriptions (Tan Tock Seng Hospital, *Personalised Medicine*). In 2022, MDL began advanced multiple-gene testing, introducing customised arrays containing Asian-specific markers, improving diagnostic accuracy (Tan Tock Seng Hospital, *TTSH Partnership*). Overall, Singapore's investments in genomic tools have allowed for the improved forecasting of genetic diseases, and the optimisation of dosage and drug selection (Tan Tock Seng Hospital, *Personalised Medicine*).

Beyond genomics, CGT-specific investments show great promise in reducing treatment costs and improving outcomes, potentially improving dynamic efficiency. Whilst many CGT options are currently more expensive than established counterparts, CGT treatments tend to be curative as opposed to life-extending (Stanford Medicine); and costs could be defrayed by further innovations supported by investment.

CGT holds promise for common diseases like hyperlipidaemia, hypertension[93] and cancer that plague Singaporeans (Evangelidis 143-160; NHLBI; MOH, *September 2022*). In pursuit of these benefits, ACTRIS[94] opened a new 2,000m^2 cell therapy facility in 2023, aiming to

[90] Genomics and CGT work hand-in-hand, with CGT personalised to individual genomic data (Kavaklioglu)
[91] Other public and private facilities, like the SingHealth Duke-NUS Genomic Medicine Centre (SDGMC) or the Mount Elizabeth Novena Centre for Genomic Health respectively also provide such services (Mount Elizabeth; SingHealth).
[92] Tan Tock Seng Hospital's Molecular Diagnostic Laboratory
[93] This is particularly noteworthy given hypertension and hyperlipidaemia affect 32% and 37% of our population respectively (MOH, *September 2022*).
[94] the Advanced Cell Therapy and Research Institute, Singapore

meet increasing demand for CGT. Moreover, ACTRIS will facilitate more public-private partnerships to help companies navigate regulatory hurdles; and have partnered with the NHIC[95] to encourage CGT adoption in local hospitals through a grant call (CRIS). However, headwinds still oppose CGT and genomics efforts in Singapore, whilst some competing needs may be under-serviced.

Notably, many hurdles discourage vital research on CGT that may shed light on manufacturing innovations which could defray the primary barrier of cost. Currently, significant regulatory barriers must be overcome before starting a clinical trial (CT). A CGT CT would require separate approvals from HSA and IRBs, through CTA, CTC or CTN submissions whilst adhering to guidelines set out by GMAC and BAC[96] (HSA). These regulatory burdens may deter research. This exacerbates already high costs arising from the novelty and personalised nature of CGT treatments.

To mitigate these challenges, the trial approval process could be streamlined through the harmonisation and simplification of regulatory pathways[97]. Moreover, CT grants[98] could have increased funding quanta, both beyond 30% of costs and respective caps[99] (NMRC). To prevent budget overruns, NMRC[100] could implement value-based payment schemes such as RSAs[101] discussed in Section 2. Lastly, to maximise CGT research relevance to Singapore, cooperation with GIS[102] and their extensive Singaporean genomic library[103] should be

[95] National Health Innovation Centre Singapore
[96] Acronyms used: Health Sciences Authority (HSA); Institutional Review Boards (IRBs); Genetic Modification Advisory Committee (GMAC); Bioethics Advisory Committee (BAC); Clinical Trial Certificate (CTC); Clinical Trial Authorisation (CTA); Clinical Trial Notification (CTN)
[97] Such as through the mutual recognition of agreements between HSA and IRB, and the consolidation of research and ethical guidelines by GMAC, BAC and other committees.
[98] Such as the CTG-Industry Collaborative Trials (CTG-ICT) and theCTG-Investigator-Initiated Trials (CTG-IIT). (NMRC)
[99] CTG-ICT: 30% total inc. 30% indirect costs; capped at $4.94M per project, up to 5 years. CTG-IIT: capped at $1.625M per project (inc. 30% indirect costs). up to 5 years. (NMRC)
[100] National Medical Research Council
[101] Such as performance incentives or reimbursement clauses when surpassing or failing to meet key benchmarks respectively.
[102] Genomic institute of Singapore (GIS)
[103] From the Singapore Genome Variation Project (SGVP)22, the SG10K_Health23 and the SG10K_med24 projects. (Bertin et al.)

promoted[104] (Bertin et al.) These changes could further improve resource allocation, multiplying the advances in dynamic efficiency made by CGT investment.

Conclusion

It is said that preventive care is the only “aspect of healthcare which bears the characteristics of an investment”[105] (Minister for Health). As resources tighten and competing needs grow, this pursuit for investment is ever more important. Whilst Singapore has made great strides in addressing these challenges, only by further decentralising and integrating generalist care, refining reimbursement mechanisms, and prioritising advancements in CGT, genomics, and telemedicine, can we better navigate the complexities of resource allocation and best meet the evolving healthcare needs of our population.

[104] E.g. through targeted grants (for GIS partnerships), increasing accessibility to GIS libraries, shared infrastructure with GIS and their labs under PPP (private-public partnership) research programs.
[105] Speech by Minister for Health, Ong Ye Kung (Y. K. Ong, July 2024)

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