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Implications of Primary Care Scenarios for the 'Performance' of Chronic Care Delivery in Switzerland: A Systems Modelling View

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ABSTRACT

Switzerland and most high-income countries are confronted with a growing number of people with chronic conditions who must be treated by healthcare systems that are designed to provide acute care predominantly. A widely supported solution is strengthening the primary care sector to better meet these increasingly complex healthcare needs. We used system dynamics to develop a computer simulation model of the driving factors and their connections to the quadruple aim of Switzerland's chronic care. The model served as an exploratory scenario analysis tool. A critical insight from the scenario analysis is that the capacity of the primary care sector can only be enduringly enhanced if the workforce is expanded and resources are shifted from inpatient and specialist care to primary care. This study should help policymakers better understand fundamental structural mechanisms and cause–effect relationships arising from changes to primary care.

1 | Introduction

Chronic non-communicable diseases (NCDs)—such as cardiovascular diseases, cancers, pulmonary diseases and diabetes—are responsible for the death of 41 million people worldwide per year (Bigna and Noubiap 2019). In Switzerland, NCDs account for two-thirds of all deaths and about 80% of all healthcare expenditures, and these numbers are expected to continue to rise (Bundesamt für Gesundheit, Schweizerische Konferenz der kantonalen Gesundheitsdirektorinnen und –direktoren 2016; *Gesundheit in der Schweiz – Fokus chronische Erkrankungen: Nationaler Gesundheitsbericht* 2015). Unsurprisingly, effective NCD management is a top priority for healthcare decision-makers and public health specialists (Swiss National Science Foundation 2015). However, the challenge is not only the increasing number of patients with NCDs but particularly those patients who receive inappropriate care for their chronic conditions. Inappropriate care leads to high follow-up costs, mainly induced by unnecessary hospital stays or emergency department (ED) visits (Caminal et al. 2004).

Effective and efficient treatment of patients with NCDs is challenging for current Western healthcare systems that were mostly built in the 1970s. At that time, the focus was primarily on treating acute illnesses and providing episodic care. Healthcare systems built primarily around acute care cannot provide continuous care for chronic disease. This has led to systemic stress and pressure reflected by increased use of ED services (Diserens et al. 2015; Shaha et al. 2015), high acute hospital bed occupancy rates with ambulatory care-sensitive conditions (de Pietro et al. 2015) and overburdened health professionals—particularly in the field of nursing and primary care (Cohidon et al. 2015).

Health policymakers are driven by how they can improve care for patients with NCDs through health reforms. Finding answers is complicated due to the interconnectedness of actors within the healthcare system, technological progress, differing health policy goals, intervals between reforms and their outcomes and the lack of thorough evaluation. We aim to provide insights into the design of new health reforms by evaluating four potential interventions in the Swiss primary care sector regarding how well they fulfil the quadruple aim of chronic care delivery (Bodenheimer and Sinsky 2014). The quadruple aim assesses health system performance in four dimensions: (i) population health, (ii) per capita cost, (iii) patient experience and (iv) provider job satisfaction.

We use simulation modelling to explore how policy changes in primary care influence the quadruple aim of chronic care. We, therefore, project the impact of the following four scenarios: (i) ongoing decrease of primary care providers (PCPs) due to ageing and recruitment problems; (ii) increase of PCPs due to measures that make the profession more attractive; (iii) continued shift of workplace from single practices to group practices, improving the work–life balance of PCPs; and (iv) improvement in system efficiency due to innovations, especially through digitalization.

Switzerland has more physicians per capita than most OECD countries, but the share of PCPs is relatively low compared to other countries. As of 2022, there were 40 002 practising physicians in Switzerland, of which 42% were PCPs (François et al. 2023). The density of PCPs has remained unchanged at around 0.8 per 1000 population in the last decade, whereas the density of specialists has increased (Hostettler and Kraft 2023). From 2016 to 2022, the number of PCPs has risen by 8.9%, whereas that of specialists increased by 20% (François et al. 2023). The PCPs in Switzerland is an ageing workforce, of which 22% are 45 years old or younger and 30% are between the ages of 45 and 54. Thirty-five per cent of the PCPs are 55–64, and 14% are 65 and older. The mean age increased from 51 in 2015 to 55 in 2020. Many PCPs aged 55 and older want to reduce their clinical activity in the next 3 years or anticipate retirement (François et al. 2023). The mean working hours for PCPs is around 44 h (Kraft 2010). There has been a steady decrease in the mean number of working hours of PCPs since 2015, and the intention to reduce working hours is also shared by postgraduate trainees and junior doctors, with 86% wanting to work 42 h or less per week (François et al. 2023). Switzerland depends on foreign doctors to meet the healthcare needs of its population. In 2020, 39.5% of doctors in Switzerland were trained partially or totally in another country, whereas 31% of new doctors specializing in primary care had been trained abroad (François et al. 2023). By 2030, a deficit in PCPs is expected, which might lead to up to 40% of primary care consultations not being able to be carried out (Seematter-Bagnoud et al. 2008). Apart from some managed-care plans in which physician groups are paid through capitation, most PCPs are paid according to a national fee-for-service scale introduced in 2004. To avoid shortages of PCPs that could undermine access to primary care, the federal government has made significant investments to bolster the number of PCPs trained in Switzerland alongside logistical and financial support for the training of PCPs (François et al. 2023).

2 | Background

We concentrate on modelling scenarios in primary care because many studies emphasize the sector's pivotal role in redesigning healthcare systems towards continuous care for patients with chronic care needs (Bodenheimer et al. 2002; Reynolds et al. 2018; Bodenheimer and Willard-Grace 2016). Primary care is considered an ideal place for community management of patients with chronic diseases due to its defining features, including comprehensiveness, continuity and coordination of care (Rothman and Wagner 2003). The primary care profession is crucial as PCPs provide twice as much health advice but at less cost than specialists (Giezendanner et al. 2020). We chose four scenarios in primary care that cover the most profound developments confronting the sector in Switzerland: the ageing of PCPs (Cohidon et al. 2015), initiatives to increase the profession's attractiveness (Mücke 2019), 'feminization' of medicine through the promotion of practice styles that reconcile job and family (Streit et al. 2019) and digitalization of healthcare as a means to increase the efficiency of the system.

According to the *International Health Policy Survey 2019*, 50.4% of all PCPs in Switzerland are older than 55 years, the third highest percentage after France (59.9%) and Germany (52.5%) among the 11 countries included in the survey (Pahud 2019). Furthermore, Switzerland has the highest proportion of PCPs (15.4%) working beyond retirement age compared to the other surveyed countries. The ageing of PCPs is problematic because a substantial proportion of the active workforce will likely retire shortly, and the recruitment rate has been low for some time. A looming scarcity of PCPs is a scenario that many health policymakers fear (Rosemann and Schneemann 2013; Cerny et al. 2016) because it will force a shift from primary care to patients using specialists and hospital outpatient facilities (Bischof and Kaiser 2021).

In 2011, the Federal Council of Switzerland published a strategy paper outlining measures to prevent the shortage of PCPs and to strengthen primary care (Bundesamt für Gesundheit 2011). It became clear that the perceived lesser job attractiveness caused the low recruitment rate of medical graduates into primary care compared to other medical specialties. Several initiatives have been implemented to improve the attractiveness of the PCP job, such as better reimbursement, further education programmes and promotion of research in the field by establishing university-based institutes dedicated to primary care (Mücke 2019). These initiatives seem to be showing positive effects as the demand for primary care residency among medical graduates has increased (Giezendanner and Zeller 2020). Therefore, projections of the number of PCPs in Switzerland are not exclusively pessimistic. Contrary to the scarcity scenarios, optimistic scenarios assume a steady rise in PCPs over the next 20 years (Zeller and Giezendanner 2020).

Another critical development in primary care is the growing number of women entering the field (Streit et al. 2019). This has reinforced the trend towards styles of practice that support work-life balance, an issue central to young PCPs. In Switzerland, the proportion of PCPs working in group practices has risen substantially from 44.2% in 2012 to 60.2% in 2019 (Pahud 2019). This trend has contributed to the field's attractiveness because working regular hours and earning a fixed salary are almost impossible for PCPs operating in single practices.

A main area for enhancement in primary care is the degree of digitalization of health services and patient data (Jimenez et al. 2021). The Swiss primary care system ranks second to last in the above survey concerning receipt and use of patient data such as (i) clinical outcomes, (ii) patient satisfaction with provided care and treatment and (iii) patient-reported outcome measures (Pahud 2019). According to the Digital Health Index, the healthcare system in Switzerland belongs to the least digitized systems (together with France, Germany and Poland) (Thiel et al. 2018). A major barrier to digital transformation, so far, has been the inability to introduce electronic patient records nationwide, partly caused by the resistance of older PCPs towards digitizing patient data (Golder et al. 2021).

3 | Methods

We first built the model structure, that is, a conceptual, qualitative model, using a participatory approach (Ansah et al. 2018; Winter et al. 2019), involving experts with in-depth knowledge of managing chronically ill people, covering inpatient, outpatient and home care, along with representatives from policy and management. Then, to translate the model structure into a quantitative mathematical simulation model, the modelling technique of system dynamics (SD) was used (Sterman 2000). After validation, the simulation model served as an exploratory tool to analyse the longer-term consequences of four primary care-related scenarios for the performance of the chronic care system.

3.1 | Model Structure

Representatives from health services research, health economics, nursing, family medicine, gerontology, emergency medicine, physiotherapy, patient advocacy, healthcare planning and public health developed the model structure in a 2-day workshop. An international expert facilitator with extensive experience in conceptual modelling in healthcare led the workshop. The facilitator used so-called scripts to structure the session (Andersen and Richardson 1997). Besides the scripts, the facilitator used a conceptual model built for a similar purpose in Singapore (Ansah et al. 2018) as a seed or backbone structure to guide the development of the model structure. The following scripts were used throughout the workshop: (i) nominal group technique script (Stroebe et al. 2010) to generate an initial set of ideas of central concepts related to chronic care; (ii) outcome elicitation script (Andersen and Richardson 1997) to produce a set of outcomes, experts considered relevant for evaluating the performance of the chronic care system; (iii) variable elicitation script (Luna-Reyes et al. 2006) to create a list of key variables, building on the insights gained in (i), that drive the chronic care system; and (iv) the structural elicitation script (Luna-Reyes et al. 2006) to create the model structure by integrating the results from the three preceding scripts.

3.2 | Model Formulation

SD is an established modelling approach within systems science. It focuses on the modelling of stocks, that is, state variables such as health states/prevalence, and flows, that is, rates such as incidence rates. Other characteristics of SD are the explicit modelling of feedback, that is, circular causality, and delays between cause and effect. Where other methods strictly prohibit the inclusion of feedback, SD promotes feedback thinking and modelling (Richardson 2020). SD has a track record in healthcare modelling with successful applications in chronic care (Kang et al. 2018; Homer et al. 2010; Jones et al. 2006) and population health (Homer et al. 2004; Milstein et al. 2010). The simulation model was created with Vensim DSS using the best SD modelling practice (Sterman 2000).

Because our main purpose was to provide insights into basic structural mechanisms triggered by the different scenarios and not to generate point-precise variable predictions, the simulation model was parameterized with stylized numbers, following the approach as cited (Ansah et al. 2014). Additionally, to better (visually) identify the effects of the primary care-related scenarios on model variables, particularly on the quadruple aim, the simulation model was initialized in a steady state. In SD, steady state refers to a situation where the stocks are in dynamic equilibrium because the inflows and outflows are of equal size. Primary care scenarios are then implemented as perturbations to the equilibrium state by suddenly changing one model variable during the simulation, creating a system shock (Ansah et al. 2014).

3.3 | Model Structure

Figure 1 shows a simplified version of our model structure. The model structure is divided into four sectors corresponding to the quadruple aim of Switzerland's chronic care system. The first sector refers to population health which is conceptualized with three stock variables (i.e., boxes/rectangles in Figure 1): (i) *healthy population*, that is, individuals with no chronic condition; (ii) *stable chronic population*, that is, individuals diagnosed with one or more chronic condition either asymptomatic or symptomatic chronic conditions who do not need frequent acute care because their conditions are stable; and (iii) *complicated chronic population*, that is, individuals with chronic diseases who need frequent acute care (Ansah

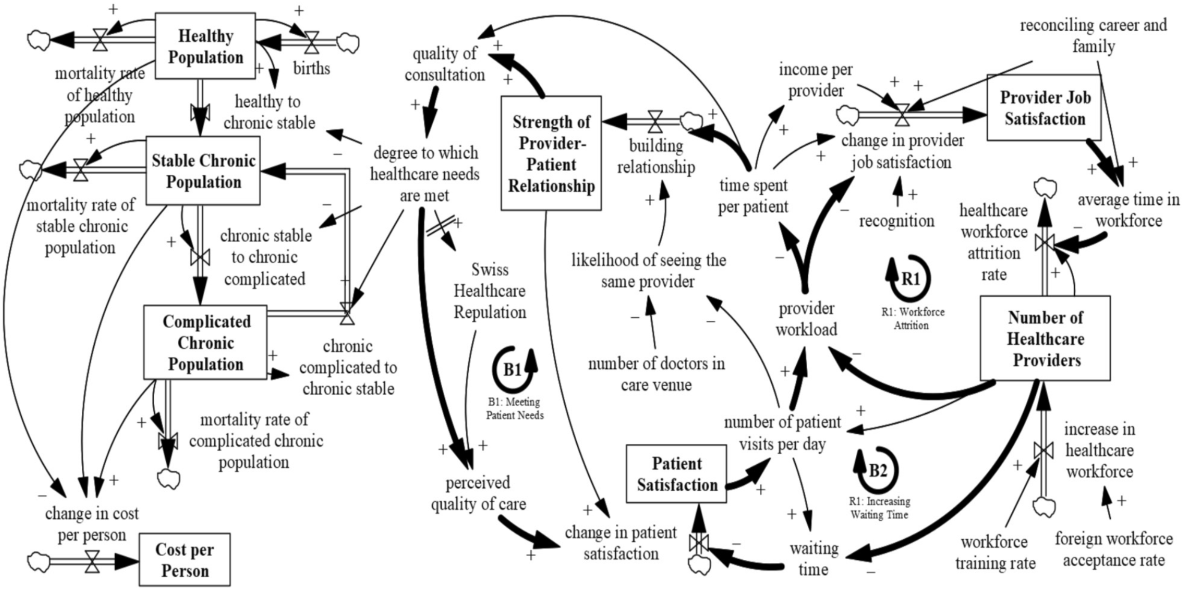

FIGURE 1 | Simplified model structure. Boxes refer to stocks (state variables), pipes/tubes connected to boxes represent flows (i.e., rate variables that cause stocks to change over time), and arrows indicate causal links across sectors.

et al. 2018; Winter et al. 2019). We define frequent acute care as three or more ED or acute hospital visits in 6 months or requiring care by more than one outpatient provider. The three stock variables are connected by flow/rate variables (i.e., pipes/tubes in Figure 1). The flows cause individuals to move ('flow') from one stock to the other. There is a continuous flow of individuals from the healthy to the stable and complicated chronic population. Additionally, there is one flow from the complicated to the stable chronic population, capturing the possibility of health improvement. The magnitude of these flows is controlled by the variable *degree to which healthcare needs are met*. So, the better the primary care system meets the needs of its healthy (but at risk), stable chronic and complicated chronic population, the smaller the flow to worse health status and the greater the flow back from the complicated chronic to the stable chronic population.

The second sector refers to healthcare costs, conceptualized with the stock variable cost per person. Cost per person depends on the distribution of people across the three stocks in the population health sector. Each stock in the population health sector has a price tag representing the average healthcare cost of an individual in that stock. We assumed that average healthcare costs increase disproportionately as people move to worse health states. We calculated the cost per person as a weighted average (with a price tag as the weight).

The third sector refers to patient experience modelled with two stock variables: (i) *patient satisfaction* and (ii) *strength of provider–patient relationship*. The expert group identified the strength of the provider–patient relationship, the waiting time for an appointment and the *perceived quality of care* delivered by the PCP as key factors driving patient satisfaction. Of interest are the dynamics that occur due to feedback in the patient experience sector of the model. For example, an increase in patient satisfaction leads to a higher *number of patient visits per day* because of positive word-of-mouth effects. However, it also leads to a higher *provider workload,* which, in turn, causes less *time spent per patient*. Less time spent per patient leads to a deterioration of the provider–patient relationship, ultimately causing a decline in patient satisfaction. This balancing feedback loop causes patient satisfaction to tend towards equilibrium in the long run (Sterman 2000).

The fourth sector refers to provider job satisfaction, modelled with two stocks: (i) *provider job satisfaction* and (ii) *number of healthcare providers*. The income per provider influences provider job satisfaction, the *recognition* PCPs receive, the degree to which providers can *reconcile career and family*, the *time spent per patient* and the *provider workload*. The *healthcare provider recruitment rate* and the *healthcare provider attrition rate* regulate the number of healthcare providers. The number of healthcare providers feeds into the patient experience sector by impacting the *number of patient visits per day*, the *provider workload* and the *waiting time* to get an appointment at a primary care facility (see Figure 1). The simulation model is provided for review in the electronic appendix. Additionally, a list of all relevant model parameters and their values can be found in Appendix S1.

3.4 | Primary Care Scenarios

Given the previously described policy context in Switzerland, we simulated the consequences of the following four primary care-related scenarios over 10 years:

1. The number of PCPs falls by 25% (pessimistic workforce scenario).
2. The number of PCPs rises by 15% (optimistic workforce scenario).
3. The proportion of PCPs working in group practices increases by 70% (practice-style scenario).

4. The overall effectiveness of the primary care system in meeting patients' needs increased by 25% in Year 1 (enhanced primary care scenario).

The percentage changes in the pessimistic and optimistic workforce scenarios are based on current projections (Zeller and Giezendanner 2020; Universitäres Zentrum für Hausarztmedizin beider Basel 2020). Percentage changes related to the practice-style scenario and the enhanced primary care scenario are informed by expert input.

3.5 | Model Validation and Sensitivity Analysis

We attained face validity of the model structure by involving subject experts in its development process and by scrutinizing scientific literature for evidence supporting the included variables and relationships. The model structure (see Figure 1) emerged from the workshop as a consensus model developed by a heterogeneous group of experts knowledgeable in primary or chronic care. The expert group confirmed face validity. In addition, all the model's causal relationships were cross-checked for evidence in the academic literature (see Appendix S2 for references).

Additionally, we assessed the validity of the simulation model by performing a multi-way sensitivity analysis for the steady state and the four primary care-related scenarios (Ansah et al. 2020). This was done to evaluate the impact of simultaneously changing all 37 model parameters on the quadruple aim. We assumed a uniform distribution for every model parameter ranging from −50% to +50% of the parameter value. We ran 500 cycles using Monte Carlo simulation.

Multi-way sensitivity analysis generated credible intervals for the four outcomes in all scenarios (see Table 1). To this end, the estimated average and the minimum and maximum values at the 95% confidence level for each run in the Monte Carlo simulation were used. Validation tests were applied continuously throughout the model-building process (see Appendix S3).

4 | Results

We ran the simulation model over 10 years and present graphical results in Figure 2. Panels A–D depict the impact of the four primary care-related scenarios on the population with complicated chronic conditions (as a proxy for population health), average cost per person, patient satisfaction and provider job satisfaction. Table 1 depicts the numeric results of the four scenarios for three specific time points in the simulation, that is, t1 = 0 years, t2 = 5 years and t_3 = 10 years, including 95% confidence intervals. We present the percentage change of the four outcomes, comparing end (t_3) with initial (t_1) points in Table 1.

In the pessimistic workforce scenario, the proportion of the population with complicated chronic conditions increases by 24% over the simulation period of 10 years. The decreasing number of PCPs causes a fall in the degree to which healthcare needs are met (−80%), accelerating the transition from the stable chronic to the complicated chronic population. Overall, population health deteriorates, and the average cost per person rises by 12.5% over 10 years. Patient satisfaction drops by 48.4% due to lower perceived quality of care, longer appointment waiting times and a weakened provider–patient relationship. Provider job satisfaction decreases by 29.1% because of the increased workload for PCPs and the worsened provider-patient relationship.

In the optimistic workforce scenario, the proportion of the population with complicated chronic conditions decreases by 3.5% by Year 10. The increasing number of PCPs causes an improvement in the degree to which healthcare needs are met, which reduces the transition rate from the stable chronic to the complicated chronic population. Over time, the stock of the complicated chronic population declines, whereas the stable chronic population increases. The population with complicated chronic conditions is 13 times costlier than those with stable chronic conditions, so the average cost per person decreases by 2% over 10 years. Patient satisfaction almost doubles (+99.1%) within the same period due to better perceived quality of care, shorter waiting times and an improved provider–patient relationship. Similarly, provider job satisfaction rises by 8.8% due to a better provider–patient relationship, reduced workload and the ability to spend more time with each patient.

In the practice-style scenario, the proportion of the population with complicated chronic conditions increases slightly by 0.8% over the observation period. A shift from solo practitioners to group practices causes the likelihood of seeing the same provider to drop, negatively impacting the provide–patient relationship. In contrast, the providers' workload in group practices sinks, allowing them to spend more time on their patients, which improves the quality of the consultation and the provider–patient relationship. These contradictory effects cause the degree to which healthcare needs are met to decrease in the first 4 years of the simulation before reversing the trend and rising continuously until Year 10. As a result, the proportion of the population with complicated conditions marginally increases over the entire simulation period. In addition, the change in average cost per person (+0.6%) and patient satisfaction (+0.8%) is only minor. However, provider job satisfaction more than doubled (+121.5%) because of a lower workload and a better work–life balance.

In the enhanced primary care scenario, the proportion of the population with complicated chronic conditions decreases by 2.7% by Year 10. By construction, the degree to which healthcare needs are met improves by 25% in Year 1 of the simulation due to an assumed improvement in primary care effectiveness (e.g., triggered by digitalizing health services). However, the degree to which healthcare needs are met gradually deteriorates until Year 10 (from +25% to +15%) because the gain in system effectiveness creates more demand for health services that must be handled with an unchanged number of PCPs. The higher workload of the PCP workforce results in shorter consultation times and a reduced likelihood of seeing the same provider, which decreases the strength of the provider–patient relationship and the quality of consultation. Average cost per person falls (−1.7%) due to improved population health over the observation period. Improving primary care effectiveness leads to increased patient satisfaction (+26.2%). The perceived quality of care stays almost constant because patients' perceptions adjust only slowly.

TABLE 1 | Numeric simulation results for the four primary care-related scenarios at $t_1 = 0$ years, $t_2 = 5$ years, $t_3 = 10$ years, with 95% confidence interval in brackets.

	Outcome	Time (years) 0	5	10	Relative change (0–10 years)
Pessimistic workforce scenario	Proportion complex	0.049 [0.047–0.051]	0.050 [0.048–0.052]	0.061 [0.058–0.063]	24%
	Average cost/patient	1277 [1225–1328]	1293 [1241–1345]	1436 [1376–1496]	12.5%
	Patient satisfaction	1 [1–1]	0.656 [0.651–0.662]	0.516 [0.515–0.517]	−48.4%
	Provider satisfaction	1 [1–1]	1.049 [1.044–1.053]	0.709 [0.695–0.722]	−29.1%
Optimistic workforce scenario	Proportion complex	0.049 [0.047–0.051]	0.048 [0.046–0.050]	0.047 [0.045–0.049]	−3.5%
	Average cost/patient	1277 [1225–1328]	1271 [1220–1323]	1251 [1201–1302]	−2%
	Patient satisfaction	1 [1–1]	1.253 [1.244–1.263]	1.991 [1.957–2.025]	99.1%
	Provider satisfaction	1 [1–1]	0.963 [0.960–0.965]	1.088 [1.079–1.097]	8.8%
Practice-style scenario	Proportion complex	0.049 [0.046–0.050]	0.049 [0.047–0.051]	0.049 [0.047–0.051]	0.8%
	Average cost/patient	1277 [1277–1277]	1283 [1231–1335]	1285 [1233–1336]	0.6%
	Patient satisfaction	1 [1–1]	0.817 [0.805–0.829]	1.008 [0.977–1.040]	0.8%
	Provider satisfaction	1 [1–1]	1.736 [1.704–1.767]	2.215 [2.172–2.258]	121.5%
Enhanced primary care scenario	Proportion complex	0.049 [0.047–0.051]	0.048 [0.046–0.05]	0.048 [0.046–0.049]	−2.7%
	Average cost/patient	1277 [1225–1328]	1264 [1214–1315]	1255 [1205–1305]	−1.7%
	Patient satisfaction	1 [1–1]	1.243 [1.240–1.247]	1.262 [1.254–1.270]	26.2%
	Provider satisfaction	1 [1–1]	1.001 [1–1.002]	0.963 [0.961–0.965]	−3.7%

However, provider job satisfaction decreases due to the higher workload (−3.7%).

5 | Discussion

The Swiss population is ageing, and a growing number of people are suffering from chronic diseases. The healthcare system, however, is still strongly oriented towards providing acute care. There is a considerable body of literature supporting the argument that primary care, if reformed sensibly, can play a key role in absorbing the healthcare needs of an older population with chronic illness. However, designing such reform(s) is challenging due to the healthcare system's complexity, lags between interventions and their effects, conflicting stakeholder interests and technological progress. We used simulation modelling to explore the long-term consequences of plausible primary care scenarios for Switzerland's quadruple aim in chronic care delivery. The insights gained from our model could inform the policy design process of adapting the primary care sector to better meet the needs of patients and PCPs.

Somewhat unsurprisingly, the pessimistic workforce scenario results in a deterioration of population health and an increase

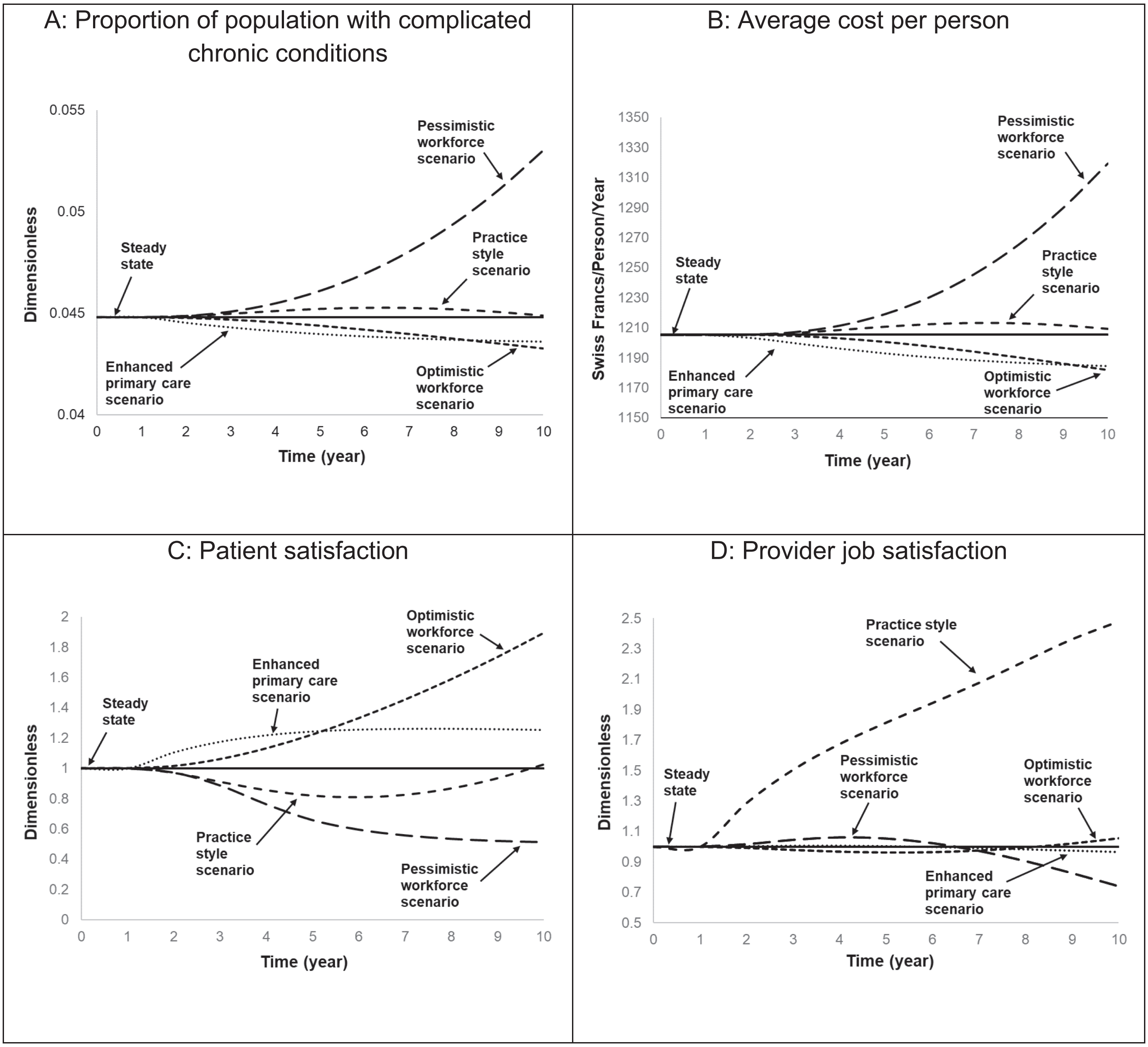

FIGURE 2 | (A–D) Effects of the four primary care-related scenarios on (A) proportion of the population with complicated chronic conditions, (B) average cost per person, (C) patient satisfaction and (D) provider job satisfaction.

in healthcare costs. These are due to the feedback loops identified in Figure 1 (i.e., B1, B2 and R1). As shown in feedback loop R1, a shortage of PCPs implies compromised access to primary care, an increased workload and more stress for the remaining providers. This ultimately leads to a drop in provider satisfaction, further increasing provider attrition. Similarly, as articulated in feedback loop B1, a shortage in PCPs implies an increased workload, causing time spent per patient to decrease and, consequently, the provider–patient relationship. A decrease in time spent per patient and provider–patient relationship will influence the quality of care provided, which impacts the degree to which healthcare needs are met and patient satisfaction. As indicated by feedback loop B2, a shortage of PCPs will increase waiting time for patients, further deteriorating patient satisfaction. However, lower patient satisfaction will lead to reduced patient visits, improved provider workload and better provider satisfaction, thereby decreasing attrition. Considering the detrimental outcomes of this scenario, policymakers in Switzerland should be urged to monitor the number of PCPs closely and to intervene decisively if current measures to increase the recruitment rate do not compensate for the significant waves of retirement expected in the coming years. What this insight adds to the debate of primary care reforms is the need to develop a comprehensive understanding of the impact of interventions on the quadruple aim of healthcare due to the non-uniform impact of an intervention on different outcomes.

In the optimistic workforce scenario, the improvement in population health and the cost reduction are surprisingly moderate. After 10 years, primary care is 40% more effective in meeting its patients' needs, slowing the progression of healthy people to stable and complicated chronic. This effect is driven by the 'redistribution' of patients among more PCPs, implying better access to care, longer consultation times and an improved provider-patient relationship. This scenario significantly impacts patient satisfaction, which nearly doubles in the simulation because of the facilitated access to primary care and improved perceived quality of care. Provider job satisfaction changes only marginally due to the increased overall number of PCPs. Although the projections of all four outcomes look favourable, the effects are small except for patient satisfaction. This might indicate to policymakers that for the current level of system effectiveness, an expansion of PCPs might not be cost-effective, and retaining the current numbers of PCPs in the country is the best strategy. However, if primary care effectiveness is enhanced, that is, through digitalization or other means, stabilization of workforce numbers will not suffice.

The practice-style scenario conserves the status quo of population health, cost per person and patient satisfaction while boosting provider satisfaction. It is reassuring that the ongoing shift to group practices in Switzerland has no profound negative implications for the quadruple aim. However, PCPs will be geographically less dispersed; thus, patients, particularly in rural areas, will have to travel longer distances to see their providers. In addition, the patient–provider relationship could deteriorate because more than one provider will treat patients in group practices. In this scenario, provider job satisfaction increases significantly, an essential factor for stabilizing the workforce. Health policymakers should, therefore, support the ongoing consolidation and transition of PCPs from single practices into group practices while monitoring the geographical coverage of PCPs closely to identify access barriers.

The effects of the enhanced primary care scenario are—except for patient satisfaction—surprisingly small. The change in population health and healthcare costs are marginal. Interestingly, the initial gain in system effectiveness due to digitalization cannot be sustained and declines gradually over time. Digital transformation in primary care presumably leads to increased breadth (e.g., telemedicine) and depth of healthcare services offered. The widening spectrum of primary care services most likely causes a reallocation of chronic care patients away from secondary and specialist care to primary care. However, the higher workload for PCPs, identified in our scenario, compromises access to care, induces shorter consultation times and leads to a worsened doctor-patient relationship. Health policymakers should bear this in mind when fostering digitalization in the primary care sector, as the positive effects of digitalization can only be sustainable if resources are shifted from inpatient and specialist care to primary care.

The insights from this study demonstrate the need to implement high-quality primary care systems across all countries as a foundation for a high-functioning healthcare system that enhances population health, reduces cost and improves provider and patient satisfaction. Primary care is unique because it is designed for everyone throughout their life course—from healthy children to older adults with multiple chronic conditions and people with disabilities. Policymakers should focus on improving the quality of primary care because evidence shows that countries with high-quality primary care enjoy better health outcomes and more health equity.

When interpreting our results, the reader should consider the limitations of our study. First, the model structure is a product of professionals' opinions and perceptions synthesized in a 2-day workshop. The outcome of such a workshop depends on who is selected (gender, age, experience and values), how well the chosen professionals interact (no hierarchies) and how well the workshop is managed. We aimed to reduce this bias and improve the outcomes' replicability by using a structured approach that relies on scripts, but we cannot completely rule out such bias. Second, the quantitative simulation model does not consider primary care interactions with other healthcare sectors (e.g., hospital care, long-term care and specialist outpatient care). It is important to emphasize that overburdened PCPs refer more patients to specialists in the hospital outpatient clinics. Consequently, increasing referrals to specialists creates greater demand for specialists, eventually drawing potential physicians away from primary care and exacerbating the shortage of PCPs, coupled with the specialists' income difference. Hence, all the interventions explored will impact the hospital system. Further research should extend the model and incorporate such interactions. Third, the simulation model may under- or overestimate effect sizes. Our extensive sensitivity analysis provides some insights into how significant the outcome variation could be. In addition, we performed comprehensive validation testing of model structure and behaviour to obtain a robust model. Fourth, as shown in Figure 1, the model structure is missing important feedback from patient acuity (percent of complicated patients) and provider workload. As the complicated chronic population increases, the average provider workload is expected to increase, exacerbating the dynamics demonstrated. Future primary care simulation models should include this important feedback to account for their impact on the quadruple aim. Lastly, since the primary aim of the study was to explore the basic structural mechanisms triggered by different scenarios—rather than to produce precise quantitative forecasts—the simulation model was parameterized using stylized inputs. As such, the effects of population ageing on the incidence of chronic illnesses were not explicitly incorporated. The model does not account for ageing, and individuals within each health state are not stratified by age. However, it is important to note that future iterations of the model intended for projection purposes should incorporate ageing dynamics. Including ageing in the current model would likely have underscored the critical need for sufficient care capacity within the primary care system.

6 | Conclusion

Our scenario analysis contributes to the ongoing policy discussion in Switzerland and internationally on strengthening primary care for treating chronic care patients. More specifically, we analysed the implications of primary care scenarios on Switzerland's quadruple aim in chronic care delivery. Policymakers may use the simulation model's insights to understand better basic structural mechanisms and the chains of cause–effect relationships linked to changes in primary care. Our simulations also show that a short-term focus may not suffice, and health policymakers need to anticipate long-term effects to improve chronic care performance sustainably. Considering our results and applying simulation modelling to specific health policy questions will help policymakers implement effective health policy reforms that benefit patients with chronic conditions and PCPs while containing costs.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section.