

Health Care: A Systems Perspective



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I. Introduction

This paper examines the health care system using the lens of systems thinking.¹ This means looking at the structure of the system to understand its behavior, where “structure” comprehends people, material, and information flows, and in addition, the feedback in the system.

This perspective is useful for examining which policies will promote health and which will not. Some of the effects of interest are:

- Investing in prevention can reduce long-term costs, but health plans and physicians are often not motivated to intervene early. How can we create a “health care” system instead of a “sick care” system?
- The adverse selection dynamic can cause a “death spiral” in health insurance enrollment. As premiums increase, the most healthy take the risk of dropping out, leaving the least healthy in the system. This further increases premiums and again the most healthy drop out.
- Insurance companies tend to want to cover the most healthy. This leaves many without insurance coverage. Their care is often shifted to expensive emergency rooms, the cost of which is paid by taxes on the general public or absorbed as costs that are shifted to those that do pay for

services.

- Positive externalities result when one person’s expenditure has a positive effect on others. We are less likely to become ill when others are healthier. Also, we are more productive when working with others who are healthier.

II. The Basic Stock and Flow Framework

Figure 1 shows the basic stock and flow structure ... what can be described as the “plumbing” of the system. Stock variables are in boxes and flow variables are at the “valves” that regulate the flows. A stock is the accumulation of the flows into and out of the stock. Feedback occurs when the value of stocks “feed back” to affect the flows.²

The Main Chains

The main chain in Figure 1 shows the stock of “Population Not in HC System” and flowing (“getting access to HC system”) into the stock of “Healthy Population in HC System.” As the “Healthy Population in HC System” become ill, they flow into “Pop in Intervention”; and, as they recover, they return to “Healthy Population in HC System”. Also, as people drop out of the system, they return to the stock “Population Not in HC System.”

¹ Adapted, and expanded on, from a basic structure in Sherry Bright and Gene Beyt, “Lessons in Systems Thinking: A Tale from the Land of Middle Health,” *The Systems Thinker*, August 1995, Vol. 6, No. 6. Pegasus Communications, Inc.

² For an explanation of the languages of causal loops and stocks and flows, see our paper, “A Brief Introduction to Systems Diagrams.”

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The other stock is “Financial Resources” which is the net accumulation of revenue and expense.

Example Links

To ease into the more complex diagrams, Figure 2 shows a few of the kinds of links that exist between variables. For example, the greater the “Pop in Intervention” the greater the “expense”. And the greater the “Healthy Population in HC System”, the greater the “number of health care policies” and the greater the “revenue”.³ Also, the greater the “Population Not in the HC System”, the greater the “uncovered costs”.

It’s useful for the reader to critically examine the logic of the links. Some are obviously correct, others perhaps not so obvious. To clarify the connections, we often need to add additional intermediate variables.

III. The Core Structure

The following subsections review the feedback loops in the system. First the “loop story” describes each loop in general terms to describe the general action of the loop. Then “following the links” traces the influences around the loops for the first several loops (frankly, it’s a lot easier to read the diagrams than the text, once the language of the diagrams becomes familiar).

Loop R1: Cost Reduction (Figure 3)

Loop story: Quality improvements reduce costs, making resources available for more quality improvements.

Following the links: More “Financial Resources” allow more investment in “quality improvement efforts”, improving the “quality of clinical outcomes”, reducing “expense”, and further increasing “Financial Resources”.

Loop R2: Outcome Improvement (Fig 3)

Loop story: Quality improvements also enable people to get well faster, reducing treatment expenses and making resources available for more quality improvements.

Following the links: More “quality improvement efforts” increase the “quality of clinical outcomes”, to increase the “rate of return to health”, resulting in less “Pop in Intervention” and less “expense” to increase the “Financial Resources” that can be invested in “quality improvement efforts”.

Loop R3: Investment in Preventive Care (Figure 4)

Figure 1. The basic stock and flow structure

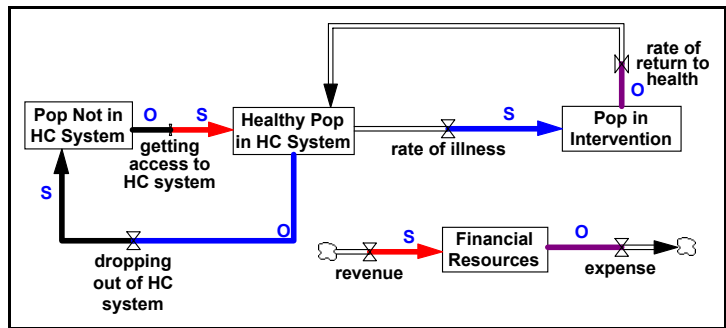


Figure 2. Example links

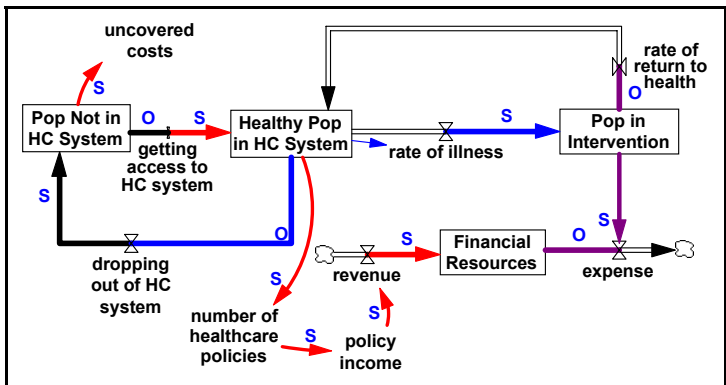
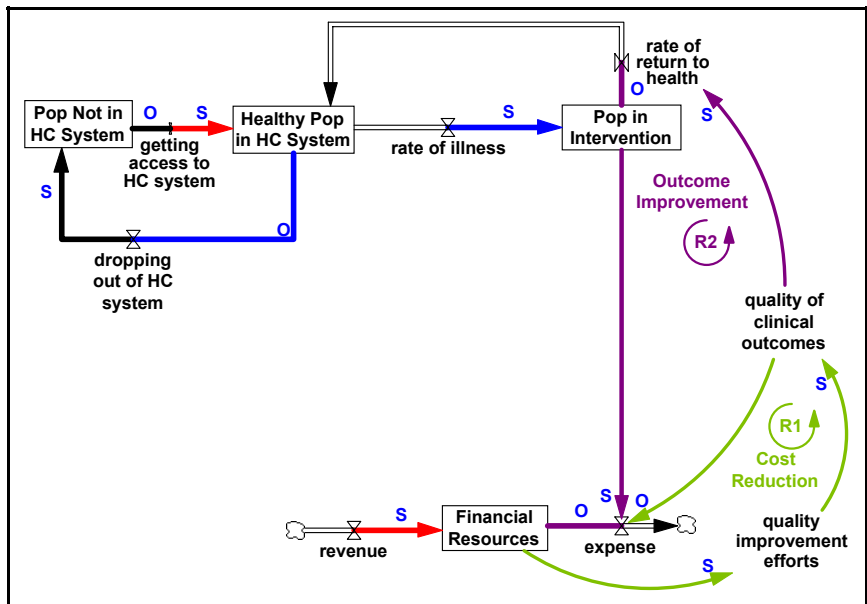


Figure 3. The loops R1: Cost Reduction and R2: Outcome Improvement



Loop story: Greater financial resources makes it possible to invest in preventive care to decrease the number of people who get sick. This reduces costs and makes possible even more investment in preventive care.

Following the links: More “Financial Resources” allows building more “institutional capacity” and investing in “preventive care”. This reduces the “rate of illness”, the “Pop in Intervention” and “expense”, ... further increasing “Financial

³ Obviously, the “number of healthcare policies” also includes those from the “Pop in Intervention”. The diagram is simplified to reduce clutter.

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Resources”.

Loop R4: Enrollment in Health Care System (Figure 4)

Loop story: Enrolling more people in the system brings in more income. This provides the resources to build additional institutional capacity that allows selling policies to even more people.

Following the links: More “Pop in HC System”⁴ increases the “number of healthcare policies” and “revenue” to increase “Financial Resources”. This allows increasing “institutional capacity” and “selling HC policies” so more people are “getting access to HC system”, increasing the “Pop in HC System”.

The Lessons of the Core Structure

It is good to invest in quality improvement; it directly reduces expense per person treated (R1) and it also reduces the number of people needing treatment (R2).

It’s even better to invest in prevention to keep people from getting sick in the first place (R3). And covering more people (R4) with fewer of them getting sick increases the resources for investing in further prevention and quality improvement.

Such added emphasis on prevention and enrollment can transform the system from “sick care” (R1 & R2) to “health care” (R3 & R4).

IV. Expanding the Structure

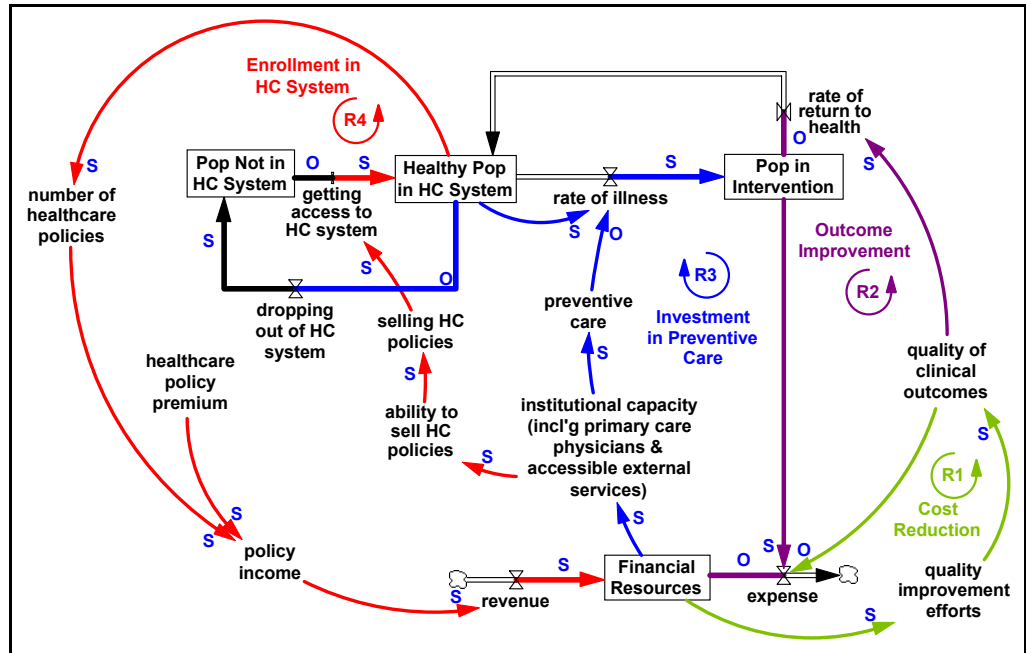
This section describes a number of loops that represent other effects in the system.

As you will see, the full diagram (Figure 12) presented here gets quite “messy.” Therefore, each of the loops in this section is shown by itself to make it easier to trace the loop.

Loops R5a & R5b: Healthy Costs Less & Increases Covered Population (Figure 5)

Loop story: More investment in quality improvement increases the health of the covered population. This allows premiums to fall, which means that (a) fewer people drop out of the system and (b) more people can afford access to the system. This provides even more revenue for quality

Figure 4. Adding loops R3: Preventive Care and R4: Enrollment in HC System



improvement.

Following the links: More investment in “quality improvement efforts” increases “health of the recovered pop” and the “rate of return to health”. The resulting greater “Health of Pop in HC System” allows reducing the “healthcare policy premium”. This both reduces (a) “dropping out of HC system” and increases (b) “getting access to HC system” to increase the “Pop in HC system”. The greater “number of healthcare policies” provides more “revenue” and more “Financial Resources” for added “quality improvement efforts”.

Loop B5: Premiums Affect Income (Figure 6)

Loop story: The reinforcing R5 loops are counteracted to some extent by this balancing loop. The problem is that, while lower premiums result in fewer dropouts and more access, they also reduce revenue.

Following the links: More investment in “quality improvement efforts” increases “health of recovered pop” and the “rate of return to health”. The resulting greater “Health of Pop in HC System” allows reducing the “healthcare policy premium”. This reduces “policy income” and the “Financial Resources” available for “quality improvement efforts”.

Loop R6: Tax Burden Affects Affordability (Figure 7)

Loop story: Here’s where those not in the system have an effect. As more people drop out there are more costs that are not covered (we don’t turn people away from emergency rooms). To the extent that the State picks up the tab, the cost is passed on to tax payers, who are less able to afford the premiums and more drop out.

⁴ Again, the “Pop in HC system” is [“Healthy Pop in HC system” + “Pop in Intervention”] ... the diagram is simplified to reduce clutter.

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Figure 7. Loop R6: Tax Burden Affects Affordability

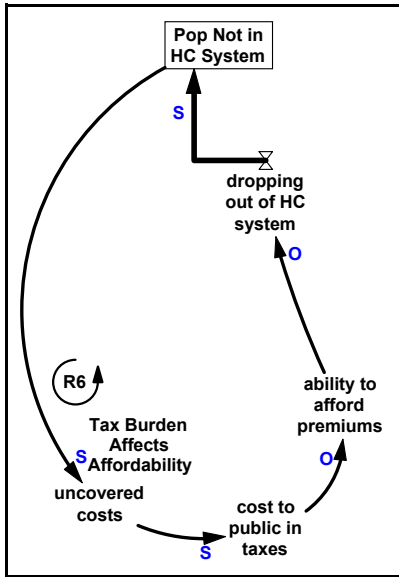


Figure 9. Loop R8: Adverse Selection

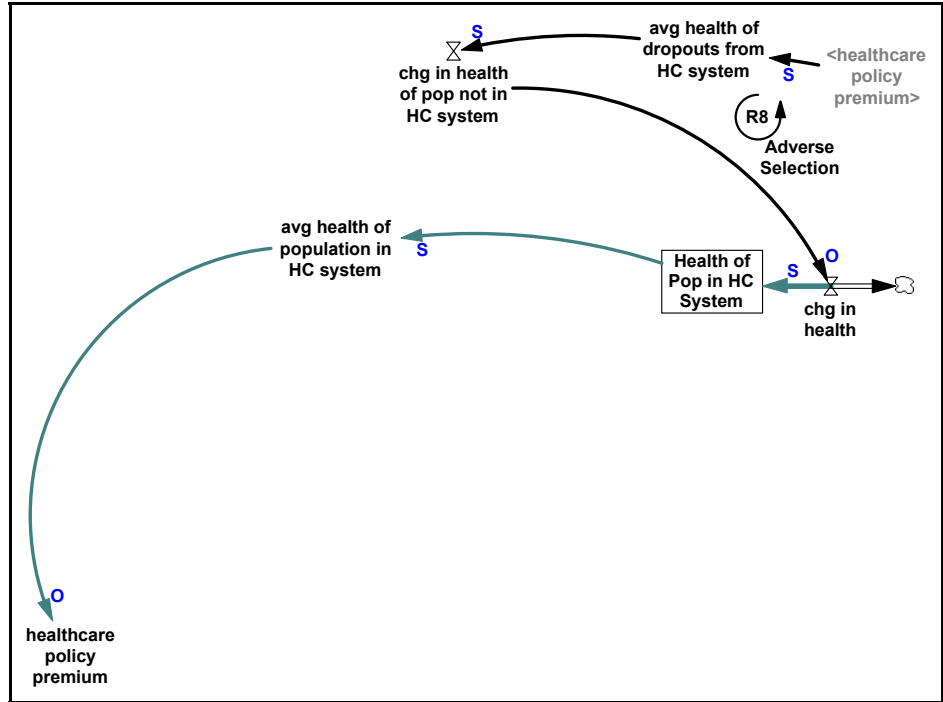
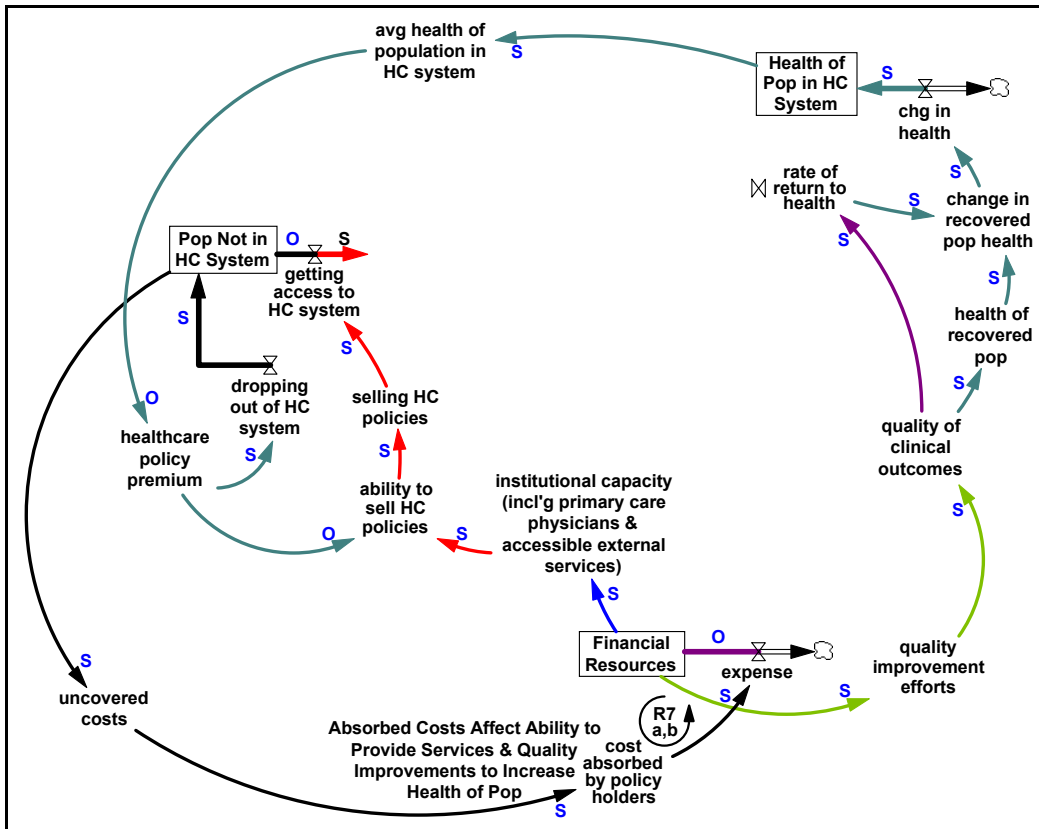


Figure 8. Loops R7a & R7b: Absorbed Costs Affect Ability to Provide Services & Quality Improvements to Increase Health of Pop



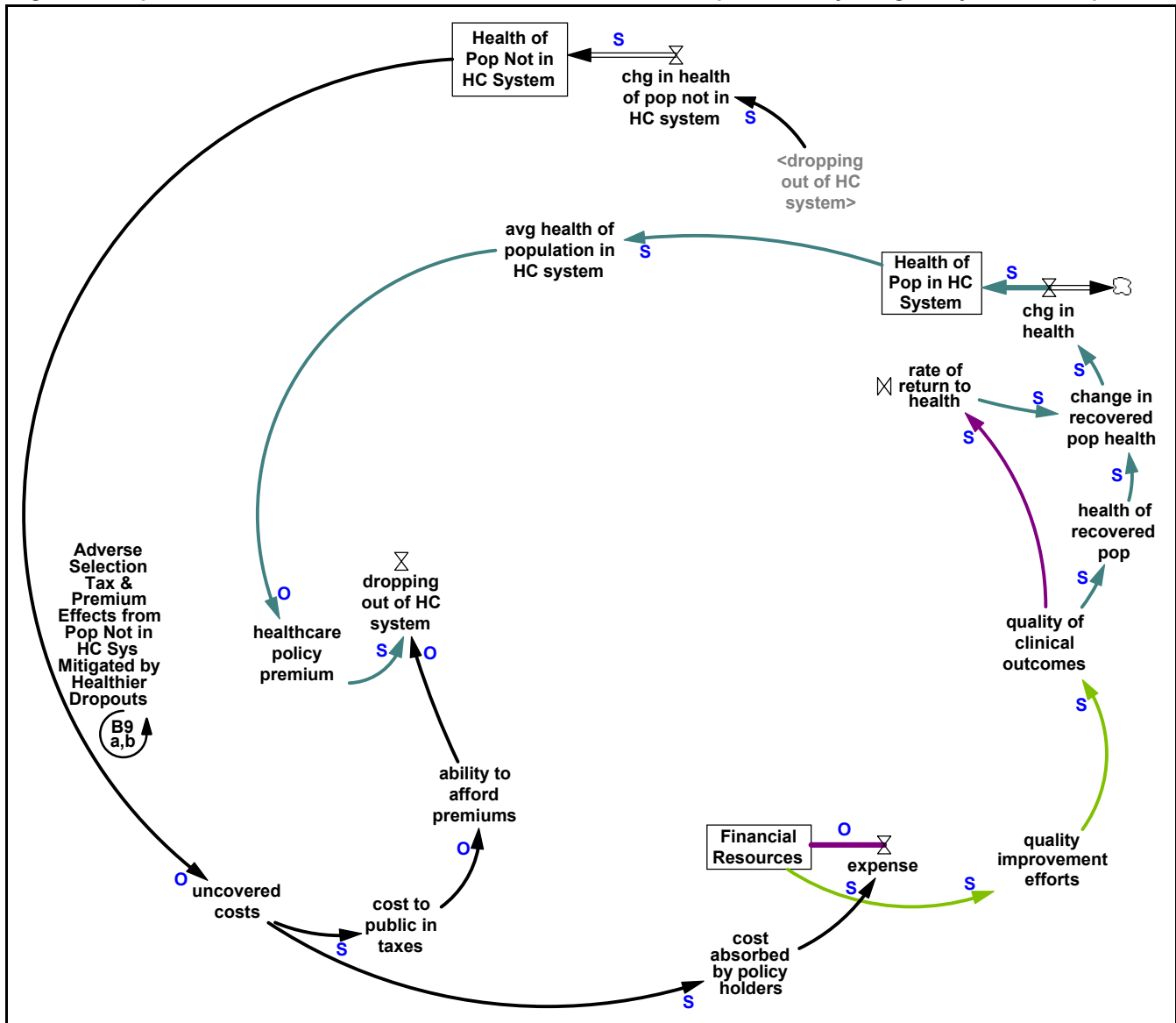
Following the links: (see diagram).

Loop R10a: HC Sys Pop Externalities (Figure 11)

Loop story: Economists speak of positive and negative externalities.⁵ Health care has positive externalities. The reason is that, if you spend money on your health care and you are healthier, then my work is less likely to be interrupted by your absence. Perhaps more importantly, when you are healthier, I'm less likely to get sick. Therefore *I benefit from the expenditures you make on your health*. That is why governments finance public health services. This loop shows this effect.

⁵ Pollution is a "negative externality." That is, it's beneficial economically for me to pollute and let the public at large clean it up ... my costs are lower and I can sell my product and realize a greater profit. (This is why we have clean air and water laws and enforcement.) Education has "positive externalities." That is, my work is more efficient and effective when I work with someone who is more educated. (This is why we have public education.)

Figure 10. Loops B9a & B9b: Adverse Selection Tax & Premium Effects from Pop Not in HC Sys Mitigated by Healthier Dropouts



As the average health of people in the system increases, the average health of the general population increases, which increases productivity and income to make premiums more affordable. This reduces dropping out of the system and increases the health of the people in the system. This creates a virtuous cycle (or a vicious cycle when it goes in the other direction).

Following the links: (see diagram).

Loop B10b: Healthy Dropout Externalities (Figure 11)

At the same time, less dropping out decreases by an equal amount the health of the population not in the system. Based on these two loops alone, these effects would cancel out and the average health would not change.

However, R10a is stronger as long as we are making quality improvement efforts and increasing the quality of clinical

outcomes to increase the health of those in the system.

Following the links: (see diagram).

V. Conclusion

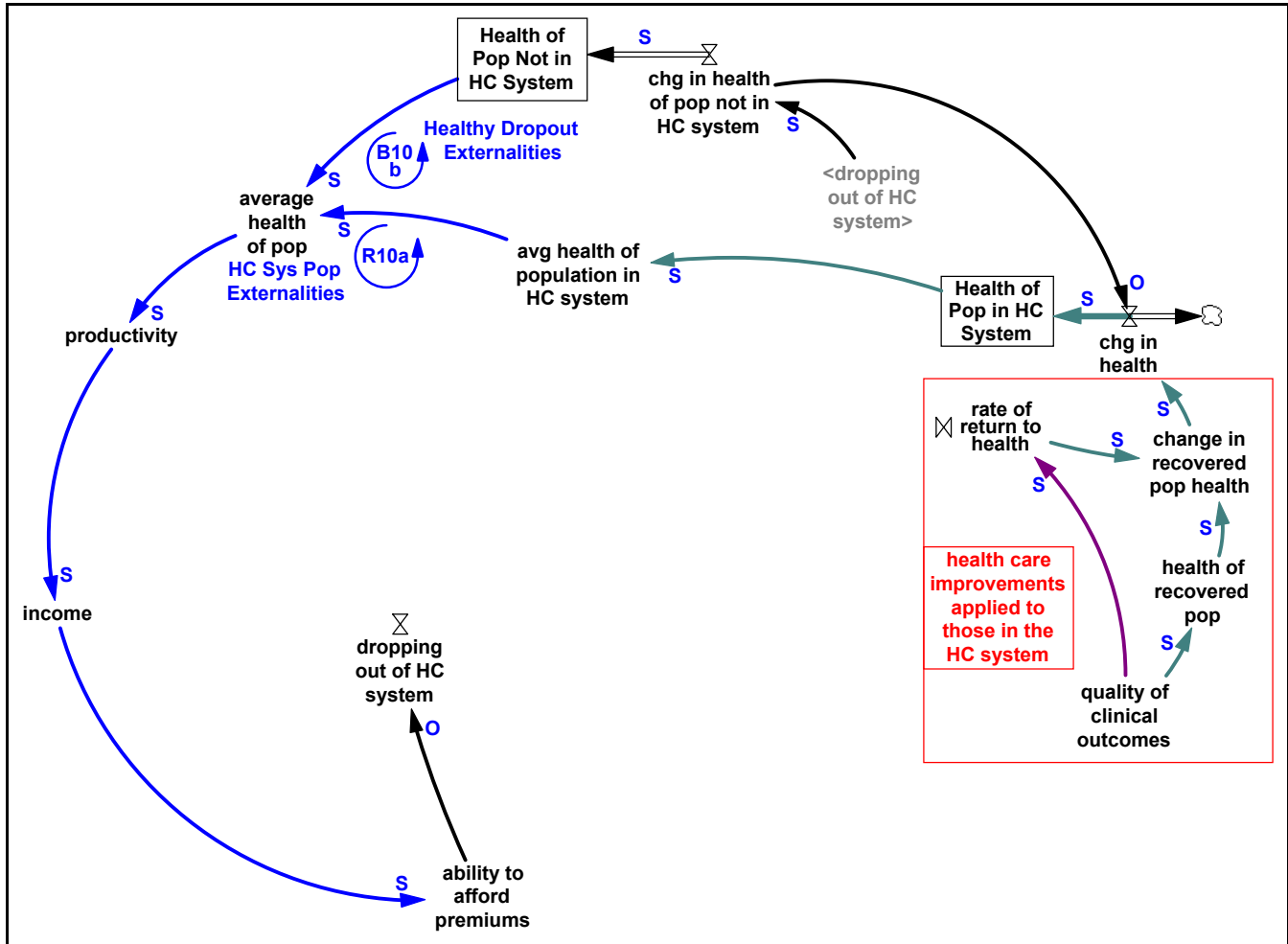
Figure 12 shows all the loops considered. What a mess! And this does not even include all the effects in the actual system.

Note that most of the loops are reinforcing. This means the system is unstable ... it's behavior over time either gets better exponentially or it gets worse exponentially. These reinforcing loops can either work for us ... or they can work against us ... in virtuous cycles or in vicious cycles.

If system behavior goes in the virtuous direction, the reinforcing action will eventually be limited by everyone being in the health care system and less and less of the population will be in intervention. A good outcome.

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Figure 11. Loop R10a: HC Sys Pop Externalities & Loop B10b: Healthy Dropout Externalities



On the other hand, If system behavior goes in the vicious direction, in the long run the systems fails for most people. Very few will be in the system and the burden will be on those who pay and on the public in taxes will continue to increase. A not-so-good outcome.

Phillip Crosby wrote a book, *Quality is Free*.⁶ In this book he points out that quality is not only free, it is a supreme source of profit. For example, for semiconductors, greater quality results in higher yields to reduce costs. It also produces more reliable products for which higher prices can be charged.

This “quality is free” concept is, however, slightly misleading. For anyone who wants to get the benefits of quality, it is free ... in the long run. But first, in the short run, it has to be paid for ... an investment must be made.

This structure shows that, in the long run, investments in preventive care and quality improvement should have similar “quality is free” benefits. The alternative is having the reinforcing loops working against us and increasing costs.

Health care costs have been rising ... and the adverse

selection dynamic will continue to make the situation even worse.

Finally, by investing in preventive care and quality improvement, we can take advantage of the benefits of positive externalities. Everyone is healthier and more productive when everyone is healthier and more productive.

This is only a beginning of the analysis that could be done. Figure 13 shows a main chain that comprehends some of the other potential “states” of the population. Examining policies to make the system more efficient, effective and adaptable would be a worthwhile endeavor.

⁶ Philip B. Crosby, *Quality Is Free: The Art of Making Quality Certain*, Mass Market Paperback Reissue edition (August 1992), Mentor Books

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Figure 12. All the loops considered.

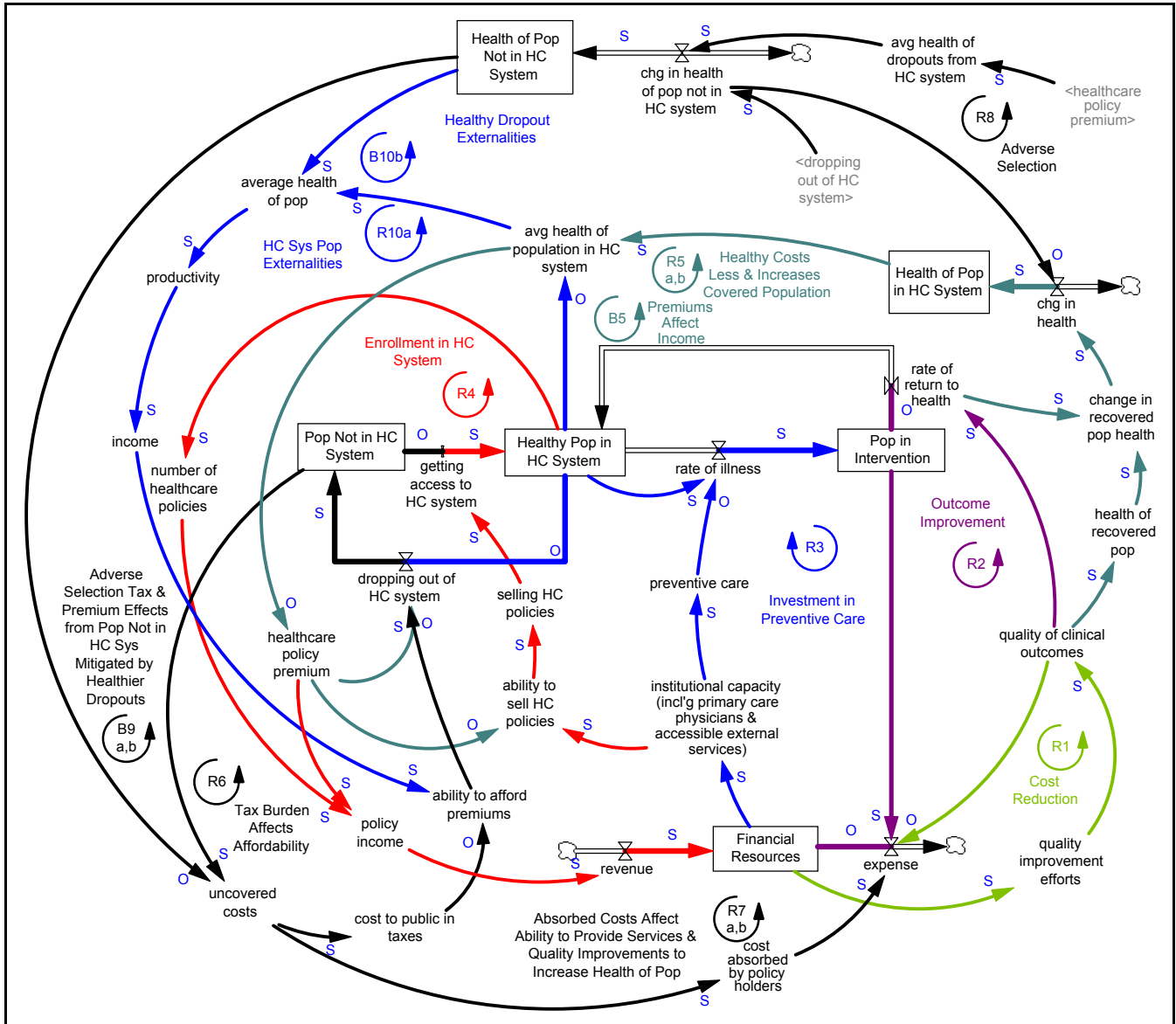


Figure 13. A more complex main chain

