

Evaluating the Effect of Integrated Health and Social Care Information Systems on Delayed Discharging of Patients in the UK

S.Sardiwal

London South Bank University
103 Borough Road
SE1 0AA
0207 815 8229
sardiws@lsbu.ac.uk

Abstract

The integration between health and social care organisations in the UK is an acknowledged public policy problem. Despite government efforts at implementing 'joined up thinking', government have found this area frustratingly 'policy resistant'.

The focus of this paper is to look at the effect that integrated health and social care information systems can have on delayed discharging of elderly patients in the UK National Health Service (NHS) and Social Services.

A case study approach has been applied of the elderly care wards from hospitals at two NHS trusts and a social services department. System dynamics and Soft Systems Methodology are used to test the proposition that information systems can achieve a significant improvement in reducing delayed discharges.

The conclusions are that these methodologies provide a sound test bed for the proposition and that integrated information systems can be useful. However, only if they stimulate action when there is limited health and social care capacity present. Integrated information systems should be used by managers to inform them of the capacity changes that need to be made throughout the patient process, helping to ensure there is a greater response and action in reducing delayed discharges.

Keywords: Soft Systems Methodology, System dynamics, Health and Social Care Policy, Information systems

Introduction

The aim of this paper is to investigate the effect that integrated information systems can have on delayed discharging of elderly patients from hospital.

Social Services is the body responsible for the provision of post hospital care and the NHS is the publicly funded healthcare organisation. Social workers have the role of providing the post hospital community services that a patient needs, as opposed to nurses who provide more of an advisory role in the discharge of a patient. This process has been outlined by the Community Care Act 2003 (Department of Health, 2003), which has encouraged joint working between the National Health Service (NHS) and Social Services. There has been a clear patient process that has existed for elderly

patients, as they move through the hospital and community sectors as illustrated in figure 1. For a hospital discharge arrangement to exist firstly the NHS must inform Social Services that the patient requires an assessment by sending social services a “section 2”. A section 2 is the first stage of referral sent by the NHS to Social services serving as a notification of the services needed by the patient. Social Services then carries out an assessment of the patients’ needs. Following the section 2, when the patient is ready for discharge, the NHS notifies social services that the patient is ready for discharge by sending social services a “section 5”. The section 5 is the immediate notification that the patients is going to be discharged from hospital to the relevant social services provision. Social services respond by ensuring that services are set up in place before the patient is discharged.

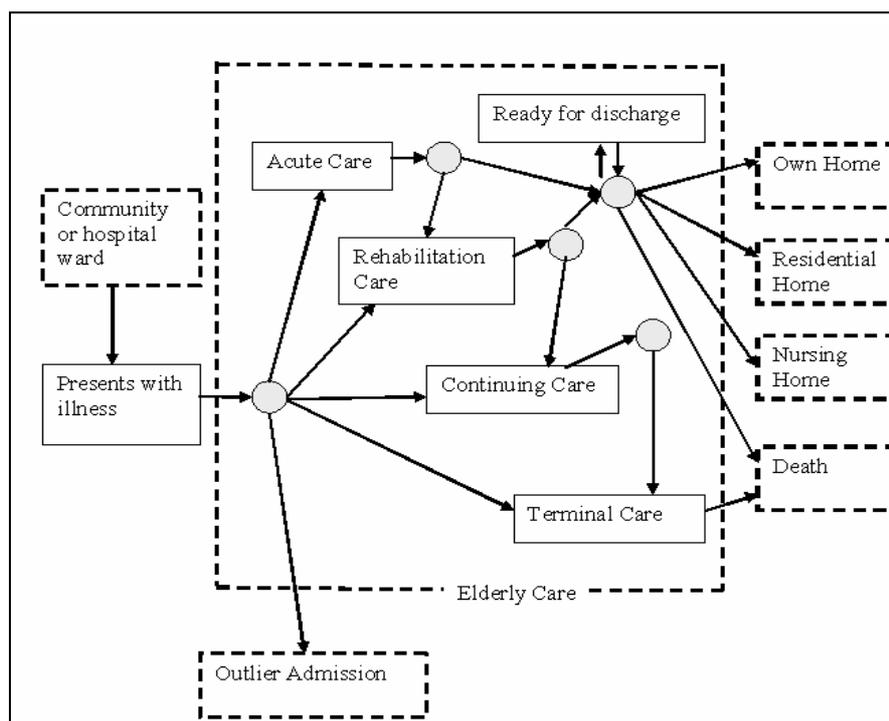


Figure 1: Lanner (2002), State transition network for phase model of Elderly Care

In theory patients should be discharged from hospital when they are fit and healthy and any social services provision required should be set up and put in place. However this does not always happen and delayed discharge occurs if the patient remains after the date the patient has been assessed as being fit for discharge. For example, social worker assessments may not have been completed at the required time for the patient to be discharged from hospital.

A dynamic problem of delayed discharge (bed blocking) has existed when patients occupy beds unnecessarily. A common sign of delayed discharge is when patients have to wait on trolleys in emergency areas. Delayed discharges were a concern of the Commons Committee of Public Accounts *‘there are still too many older people waiting longer in hospital than necessary’* (Baumann et al, 2007). User comments regarding the responsiveness of older services towards their needs have included *‘felt let down by the time it took to offer any assistance’* (Social Services Inspectorate, 2003).

In practice the delayed discharge problem has been predominately a bigger issue among the elderly population, as elderly people are a major group that receive service provision. Elderly people use 28% of the hospital beds (Lanner, 2002). The National Health Service and Social Services have been responsible for making hospital discharge arrangements for elderly people. These hospital discharge arrangements have typically involved making sure that the right post-hospital care plan is in place, monitoring the needs of patients and identification of the help required when elderly people have left hospital.

The government has tried to resolve the problem of delayed discharges by introducing a fining policy, stating that social service departments were to be fined for patients that have waited in hospitals unnecessarily (BBC, 2000). Delayed discharges also have created further deterioration of the patient, as many patients wait for the preventative services that they need (Social Services Inspectorate, 2003).

Patient delays have occurred due to four main contributory factors; health and social care capacity issues, internal hospital inefficiencies, inter-agency issues (Baumann et al, 2007) and the individual patient. The sources of delayed discharge which has been focused on in this research concerns health and social care capacity issues and inter-agency issues.

Integrated health and social care provision problems

There are a large number of complex, systematic problems among integrated health and social care provision, making this an important research area. Reasons why the situation is particularly problematic are now discussed.

The division between health and social care organisations has often been described as the 'Berlin Wall'. There has been the challenge for health and social care organisations to work together across the different boundaries that they face. These boundaries are largely cultural and organisational (Department of Health, 2005).

Poor information management exists amongst many new integrated services. Situations where financial information has not been integrated between health and social care organizations result in pooled budgets not being used to their maximum. Similarly there was a poor mismatch of data between the Child Support Agency System and the Jobcentre Plus System, which resulted in the Child Support Agency receiving less child support cases (Collins 2003, Rodgers 2003). Legislation from the Data Protection Act has prevented information sharing amongst the NHS and Social Services (BJHC, 2003). Progress in integrating health and social services has been slow due to the practical difficulties that exist with organizations. For example mental health service provision is experiencing recruitment problems among social workers (National Institute for Mental Health in England, 2003).

Health care and social care organisations are continuously scrutinised. The NHS has been scrutinised over 'needless' waits in Accident and Emergency departments (A & E) (BBC News, 2005). Services have been particularly problematic when service users demonstrate a high level of complex needs, such as with older people and with people with physical disabilities (Oxfordshire County Council, 2004). There are huge differences in the way organisations describe themselves working and the way these

organisations are actually observed in practice on a daily basis (Monk et al, 2005). There has been recognition that organisations need to be better co-ordinated in order for the needs of service users to be met.

Public sector information system failures

There have been numerous high profiled information system failures within the health and social care environment including the cases of the London Ambulance Service (LAS) (Collins et al, 2005) and Hillingdon Social Services.

The literature has shown that there are increasing external and internal organisational pressures placed on health and social care organisations. Indeed this has been the case historically. Under 'new Labour' there has been a move to increase integrated service provision due to the advantages associated with this type of provision.

With government initiatives of integrating health and social care there are numerous problems in information sharing, with barriers to change existing between the NHS and the local authority Social Services. The management of the health and social care interface has been particularly problematic. There is a lack of understanding from health and social care managers as to what effect current and future information systems would have on service provision for patients. This has caused a huge number of problems, such as uninformed information system policies being put in place that have lead to the wastage of financial resources.

These problems could be explored by devising a simulation model to illustrate the effects that an integrated information system could have on delayed discharging of patients. There is a need to use systems thinking as an approach to solve these information system policy problems and to help deal with the complexity, interdependency and feedback that exists between health and social care systems. Exploring the use of information systems within the health and social care interface is important since there has been a growing need to use information systems to improve both service provision and the way that organisations work with new technological advances.

It is evident that a number of organisational problems have arisen as a result of poor service provision. There have been ongoing occurrences of information system failure within the health and social care context.

Using system dynamics to investigate use of an information system policy

System Dynamics has been defined as 'the branch of management science which deals with the dynamics and controllability of managed systems' (Coyle, 1996) and as 'a theory of the structure and dynamics of a system' (Barlas, 1996). The approach can be seen as 'a method of system analysis for management' (Forrester, 1968).

There have been a number of applications of system dynamics to evaluate information systems. Wolstenholme et al suggests using system dynamics to test the benefits of information systems during designing the use for the information system (Wolstenholme et al, 1993). In particular Wolstenholme et al investigated the

contribution of information timeliness, accessibility on major organisational performance measures.

Coyle used system dynamics to investigate the use of an information system policy to address the Domestic Manufacturing Company's manufacturing problem (Coyle, 1996). Coyle addressed a manufacturing problem for a company producing washing machines, in which the company was unable to forecast the inflow of new machine orders. As a result it was difficult for the company, in particular the raw materials department, to cope with the unpredictable order patterns and over and under ordering was experienced. A system dynamics model was constructed with the aim of analyzing the robustness of the overall policies for running the business.

The policy of introducing an information system to control the quantity of raw material was tested. The raw material manager saw the information system as a good idea as information would be provided to show the raw materials needed to fill the orders. The model illustrated that there were more sustained oscillations in the backlog of ordered machines and the desired backlog of machines, which were closely aligned. However the simulation illustrated that there was no great control of the raw material stock and of the desired raw materials as the policy for the number of weeks of average production was kept the same. The company produced at the same rate regardless of the fluctuations in raw materials. Coyle highlighted that implementing new policies may not be enough to be effective in any system, as they change the whole system, and other existing policies might need to be changed (Coyle, 1996).

The literature has shown that there are few good predictive system dynamic models for testing out the impacts of different information system policies on the dynamic problems concerned. An exception to this is the work of Wolstenholme et al in hospital and social care capacity planning and in addressing the coping policies that are used by health and social care organisations to meet patient demand (Wolstenholme et al, 2007). As a result stakeholders' understanding of how the whole health and social care system works has been limited (Local Government Association, 2003).

No model exists to evaluate the effect that integrated health and social care information systems have on delayed discharges in elderly care. Whilst this research cannot solve all public sector problems, the key problems it has addressed within public sector information system and development are the following:

Problem 1: There has been a lack of public sector organisations' understanding towards the impact that information systems have on service provision. This has led to the problem of organisations implementing information systems that do not support their business activities. The lack of public sector management understanding of information systems has led to inadequate testing of information systems. There has been a low uptake of information systems within the health sector as indicated by informatics research (Riley and Smith, 1997).

Problem 2: The gap in the literature is that there is no generic tool available to help support public management understanding of the impacts that information systems have on delayed discharging in elderly care. This has led to poor management of the health and social care interface. Management deploy poor information system strategies and fail to give direction to information system projects. The impacts of whole system care

on service provision are not sufficiently evaluated or monitored. There is low utilisation of information systems by managers. The lack of a generic tool has made it easier for public sector management to cover up and in some cases not acknowledge information system problems.

Methodology

A case study was carried out of the elderly care wards at St Thomas NHS Trust and Kings College NHS Trust and Southwark Social Services. Southwark Social services was selected as an appropriate case, as Southwark historically exhibited high levels of delayed discharges within the elderly care wards. This local authority had been planning to use integrated information systems across health and social care departments in the future. The system dynamic models produced that highlight the effects of their information systems on delayed discharging would prove to be highly useful to these organisations. The system dynamics methodology (Forrester, 1968) has been used in conjunction with the Soft Systems Methodology (SSM) (Checkland and Scholes, 1999), in particular the element of rich pictures.

Outlined in this paper are three main stages. The first stage has been to understand the reference mode behaviour and then construct a model to generate the reference mode behaviour. This is followed by the second stage of testing the effect that an integrated information system policy would have on the reference mode. In addition to this a third step has been added which has involved adjusting existing policies to incorporate the integrated information system policy.

Qualitative Data

There was strong involvement with stakeholders throughout the project. Twenty one interviews were carried out with a range of stakeholders including social services managers, the hospital discharge manager, intermediate care manager, information system managers and the NHS nurses. Qualitative data was collected on the patient process and the main delays and problems that existed in the health and social care system. In addition data was collected concerning which current information systems were used, the benefits of existing information systems, the current problems in information sharing, how current information systems affect service provision and what would be the possible effects of integrated information systems. More specific qualitative data was collected from health and social care managers. For example on which key performance indicators are used to measure the NHS and Social Services elderly process and how increased workloads would be resolved in meeting targets of prompt discharge.

Qualitative data was collected as part of a survey questionnaire to evaluate the health and social care simulation model. The survey questionnaire was split into three sections. Section A ascertained whether the research participants involved in using the flight simulator were the same research participants involved in the initial interview to discuss the health and social care process, and whether they felt prior to using the flight simulator that integrated information systems would affect service provision. Section B set out to ascertain whether the research participants had used simulation modelling before. Section C was designed to find out the research participants' opinions of the simulation model in relation to the following six different areas, their understanding of

the model, their views on the model's complexity, validity, usefulness, simulation results and their overall opinion about the simulation model.

Quantitative data

Quantitative data was collected from a range of sources. The NHS data referring to the elderly care wards were collected directly from the NHS information department and the Social Services data was collected through making a Freedom of Information Act request to Southwark Social Services and Southwark PCT. A range of secondary sources were consulted which included those at Guys and St Thomas NHS Foundation Trust, the Department of Health and the Commission for Social Care Inspection. The type of data provided by the NHS information department included admission levels of patients in the ward, patient lengths of stay, readmission rates of patients and death rates. Social Services provided data such as delayed discharge numbers of elderly patients, staff numbers of social workers and referral rates to social services.

Structuring data using annotated system dynamics diagrams

A reinforcing loop is self reinforcing and promotes more of the same action, where as a balancing loop is self-correcting, controlling, where the loop counteracts change. The major reinforcing and balancing loops are outlined below, where there are predominately balancing loops in the model.

The main reinforcing loops are R1 and R2 shown in figure 2. The more patients that have finished section 2s and 5s the more spare notifications capacity becomes available for social workers to for fill section 2 and 5 requirements. This is the 'one in one out' principle.

The main balancing loop is B12, which is a loop controlling those patients 'in assessment' to 'total notifications' for section 2s (see figure 3). The same principle is applied with loop B15 to section 5s.

A number of balancing loops exist (B19 to B22) whereby patients are in bed at different stages of the patient process increasing the number of patients in occupied beds, leading to a decrease in those patients in free beds. Any free beds available increases the number of new patients being admitted to the ward which leads to an increase in the number of patients in beds.

There are some patients that do not require any section 2s or 5s as they do not require any post hospital social services provision and they bypass social services involvement.

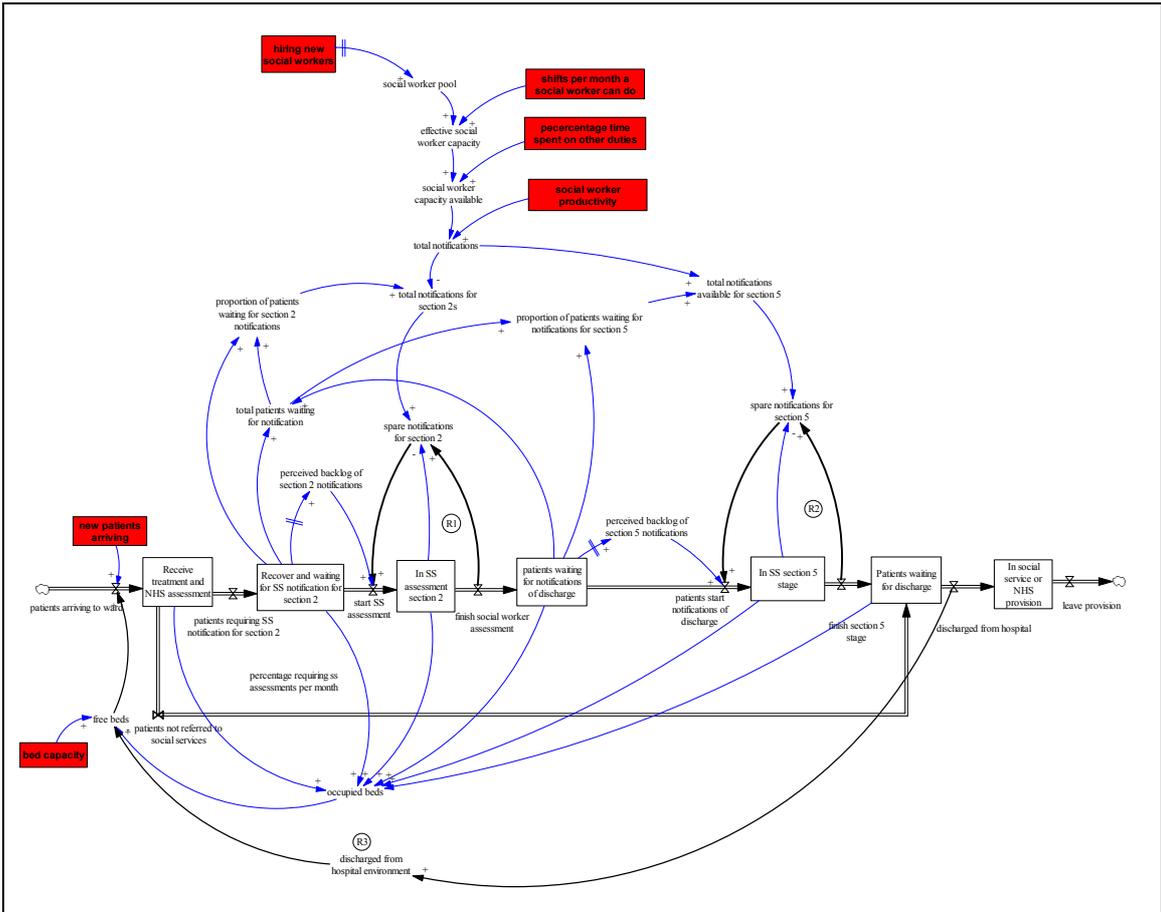


Figure 2: Annotated stock and flow diagram illustrating the reinforcing loops present

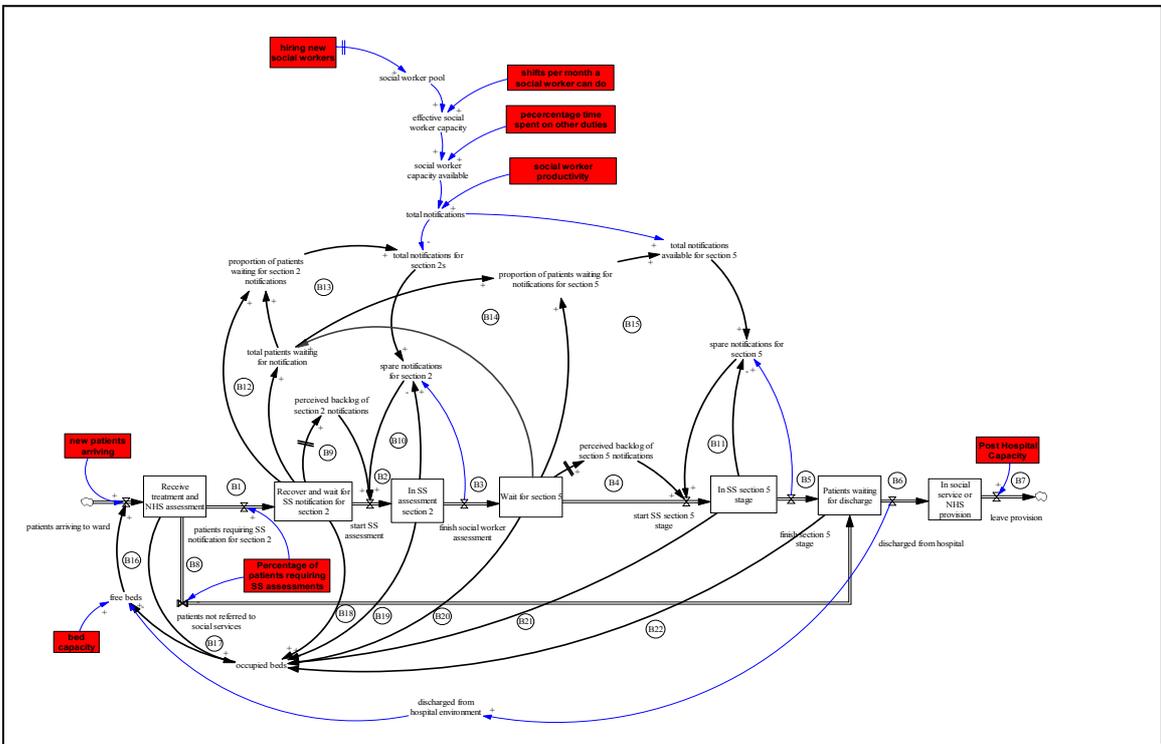


Figure 3: Annotated stock and flow diagram illustrating the balancing loops present

The main internal policy levers that exist (see figures 3, 4) to reduce delayed discharging are:

1. Decreasing the number of patients that are referred to social services for a patient assessment
2. Reducing the number of patients that enter the elderly care ward
3. Decreasing social worker time spent on other duties
4. Increasing social worker's productivity
5. Hiring new social workers
6. Increasing bed capacity
7. Increasing post hospital social services capacity such as in residential and nursing homes and the number of district nurses available

The formal System dynamics model

Reference mode data

The reference mode data for hospital delayed discharges from Kings and Guys and St Thomas NHS hospital trusts is from the period of 2001/2 to 2007/8. It illustrates a stable period of delayed discharges between 2001 to 2002, then steady growth 2002-2003 peaking in 2003, followed by steady decline in delayed discharges reaching minimal numbers of delayed discharges in 2008 as shown in figure 5. Actual delayed discharge figures are provided in figure 6.



Figure 5: A graph illustrating the reference mode behaviour of delayed discharges of elderly people from 2001 to 2008

Year	Delayed discharge of older people over 65 at Kings and Guys and St Thomas for Southwark's patients (average number delayed per day rounded to 2 decimal places)
2003/4	2.56
2004/05	0.87
2005/06	0.37
2006/07	0.49
2007/08	0.51

Figure 6: Harris (2008), Delayed discharge numbers of older people over 65 per month from 2003-2008¹

Computer generation of the reference mode

The reference mode of delayed discharges of patients was generated from a number of different parts of the patient process. Delayed discharge of elderly patients in hospital is caused by a number of factors as shown in figure 7. This gives rise to high levels of system complexity.

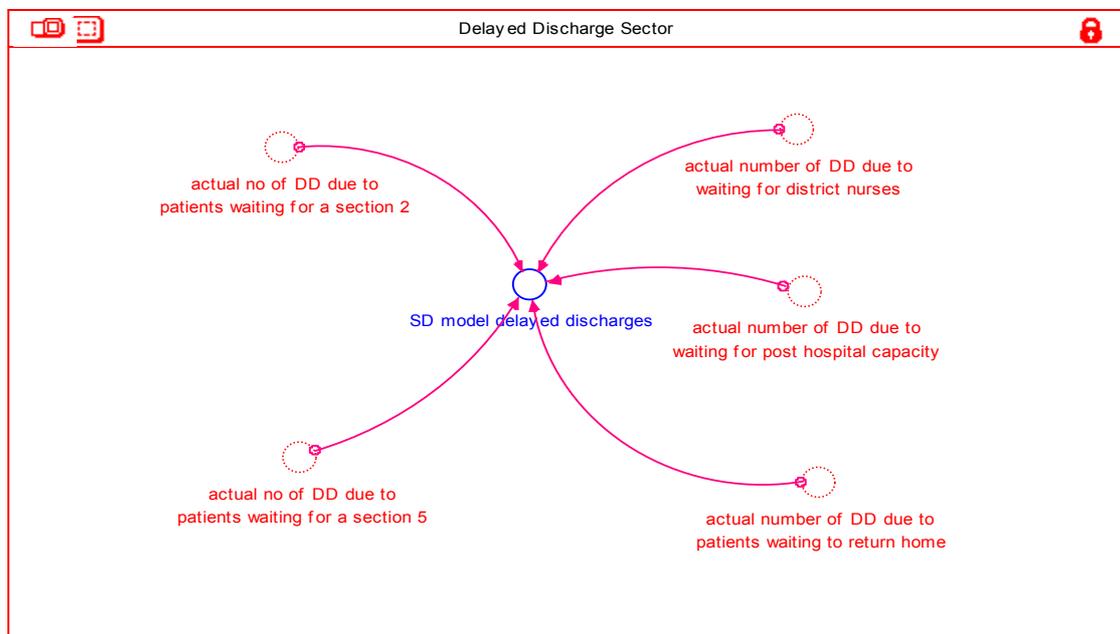


Figure 7: Causes of delayed discharge (DD) of elderly people in hospital

Organisational policy in practice in response to this peak of delayed discharges in 2003 was to increase social worker pool by 20% (policy 1) shortly after the high delayed discharge numbers became apparent. The intention was to increase the total number of

¹ Delayed discharge data was unavailable prior to 2003. However an approximation was given as to the delayed discharge figures by Southwark Social Services Management team.

assessments available for patients by recruiting more social workers, eliminating any backlogs of patients waiting for assessments at different stages of the patient pathway.

This policy was tested out using the model to try to generate the behaviour reference mode. The policy did reduce the delayed discharges at section 2 (upstream²). However the policy simply translated to a backlog of patients waiting to be discharged from hospital into the appropriate post hospital capacity downstream. This is due to patients experiencing limited district nursing capacity and other post hospital capacities further along the patient process, such as there being limited residential and nursing homes available. This model showed that total delayed discharges increased significantly as shown in figure 8. The delayed discharges of patients reach a maximum level due to the lack of available beds to admit patients, stopping any further delayed discharges from occurring.

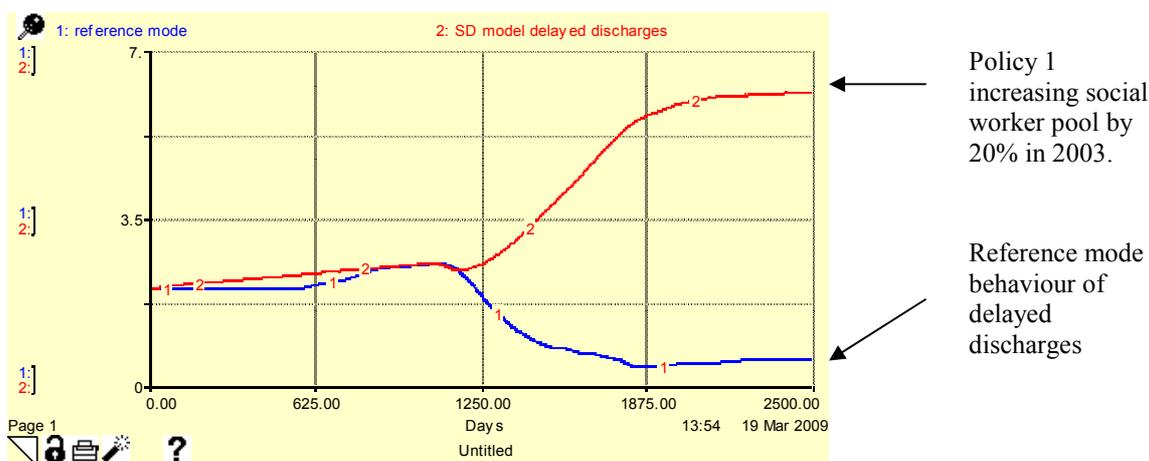


Figure 8: Model behaviour as a result of increasing upstream capacity and keeping downstream capacity the same

It was necessary to then go back to Southwark Social Services to see what other policies they used to reduce delayed discharges of elderly patients. It was discovered historically to avoid large increases of continued delayed discharge as shown in figure 9 a second organisational policy was adopted to increase the district nurse capacity (policy 2). A third policy was used to increase other post hospital capacity (policy 3) in 2003 slightly after increasing social worker capacity, leading to the overall policy 4.

Delayed discharge policies	
Policy 1	To increase social worker pool by 20%
Policy 2	To increase district nurse capacity
Policy 3	To increase other post hospital capacity, such as residential, nursing homes
Policy 4	To increase social worker pool by 20%, increasing district nursing and increasing other post hospital capacity

Figure 9: Southwark Social Services policies used to reduce delayed discharges in 2003

² Downstream refers to along the end stages of the patient process, away from patients being admitted to the ward and upstream is toward the source of patients being admitted into the ward.

This investment in increasing capacity downstream as well as upstream ensures that the total delayed discharge continues to fall and the excellent fit of the model generated reference mode to the real world data validates the model against the reference mode. This experience also reinforces the important point that delayed discharges are multifaceted as seen earlier (see figure 7) and occur in a number of different places along the patient process. As patients flow from one point of the system to another, changes in one part of the system will cause effects in other parts of the system.

The reference mode behaviour of delayed discharge is generated in the system dynamics model by increasing both downstream and upstream capacity, with the model output illustrated against the actual reference mode behaviour as shown in figure 10. The introduction of policy 4 gives a much closeness of fit between the reference data and the computer generated mode, helping to validate the system dynamics model.

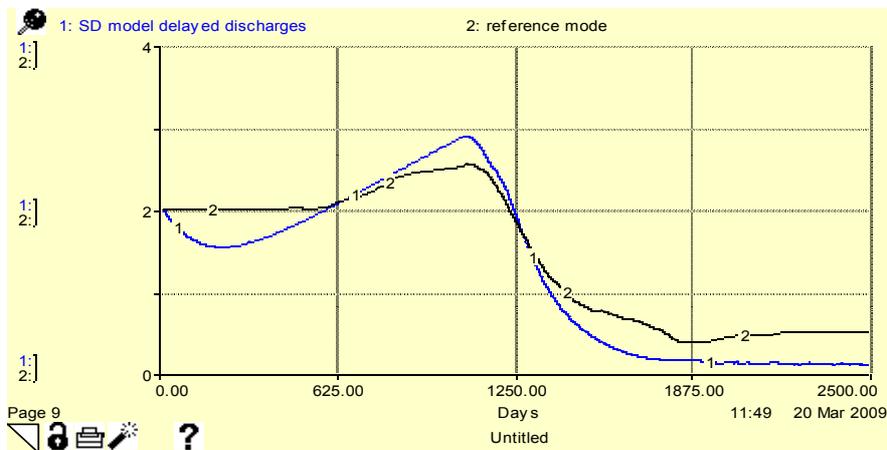


Figure 10: Reference mode behaviour against the output of the system dynamics model

Figure 11 shows the behaviour of policy 1 when the social worker pool is increased by 20% in 2003. At this stage when this policy starts to take effect it can be seen that patients waiting for discharge to district nursing begins to increase further along the patient process (see point A, figure 11). This is due to more patients receiving patient assessments as social workers are increased downstream. This causes a backlog in patients waiting to be discharged into nursing homes, as patients become delayed due to a lack of district nurse capacity downstream. This increase in actual delayed discharge starts to decrease as soon as policy 2 takes effect and the pool of district nurses starts to increase (see point B, figure 11). This injection of district nurses ensures there is sufficient nurse capacity to cope with the backlog of patients waiting for district nurses.

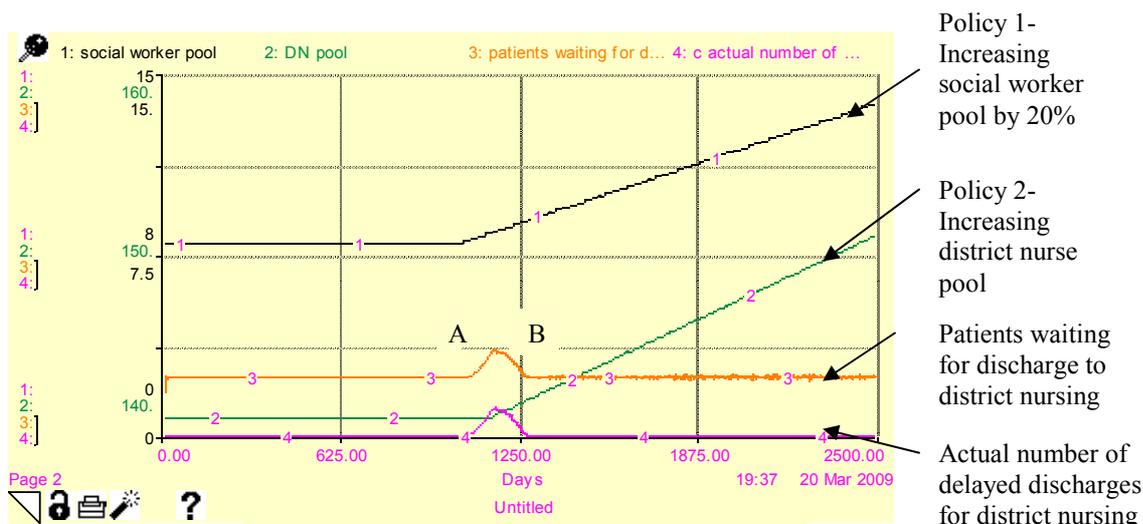


Figure 11: The effect of the policy of increasing district nurse capacity in addition to increasing social worker capacity

An integrated information system is tested in the 2nd stage as an alternative to the three organisational policies used by Southwark social services in 2003, where there were increases in social workers (policy 1), district nurses (policy 2) and post hospital capacities (policy 3) in 2003. This was to see if an information system could bring delayed discharges down without the need to increase capacity levels.

The policies tested in the proceeding section are outlined in figure 12.

Delayed discharge policies	
Policy 4	To increase social worker pool by 20%, increasing district nursing and increasing other post hospital capacity
Policy 5	To use an integrated information system to reduce patient delays whilst keeping capacities unchanged with no enforcement of policies 1-4
Policy 6	To use an integrated information system to reduce patient delays, deployment of times of assessments and accuracy of patient information in addition to policy 4 taking effect
Policy 7	To use an integrated information system to recruit social workers whilst not increasing any other capacities
Policy 8	To keep all the capacities the same and not make any new changes
Policy 9	To use an integrated information system to recruit social workers and district nurses whilst not increasing any other post hospital services
Policy 10	Integrated information system used to recruit social workers, district nurses and post hospital capacity

Figure 12: Policies tested with insufficient capacity being present

Testing the effect of an integrated information system policy when there is insufficient capacity levels

The effect of using an integrated information system to reduce patient delays as an alternative policy in 2003 to increasing capacities is shown to significantly increase delayed discharges (see figure 13 policy 5). The integrated information was used to reduce the delays in deploying and sending sections 2s and 5s from the NHS to Social Services and reducing the time taken to clear patients for post hospital services.

This policy was introduced at a time when there was insufficient capacity present and delayed discharges were on a steady increase. As delays such as those around the deployment of assessments and the time taken in sending patient information from the NHS to social services and vice versa are reduced, patients move quickly through the system until they become blocked against capacity constraints. This causes actual delayed discharges to increase.

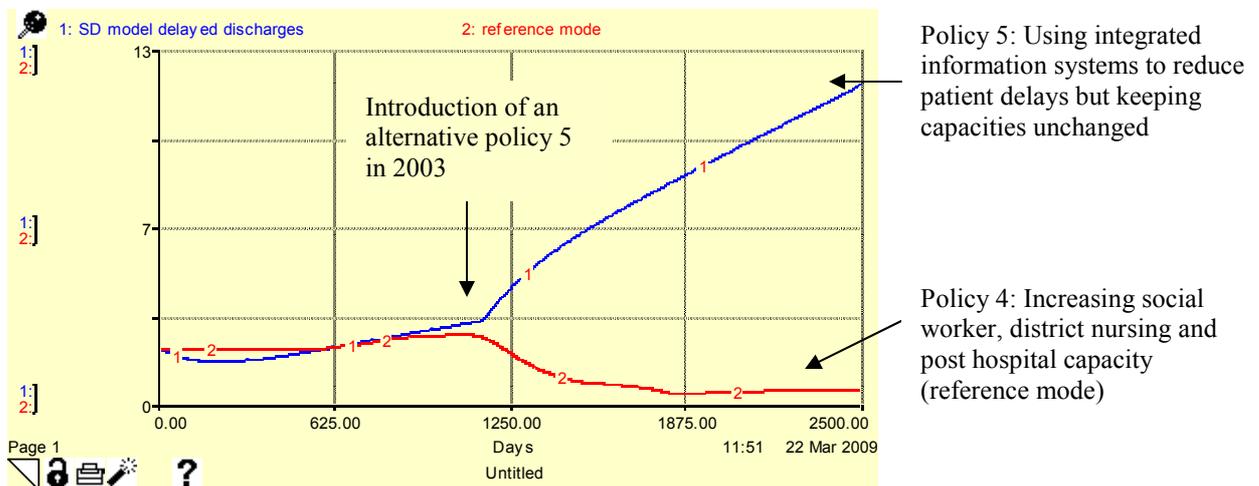


Figure 13: The effect of using an integrated information system to reduce patient delays when there is a lack of capacity throughout the patient process

However when patient backlogs are increased even further in 2003 by increasing the number of patients referred from 50% to 55% from the NHS to social services the integrated information system can be seen to have a bigger effect in increasing delayed discharges (see figure 14).

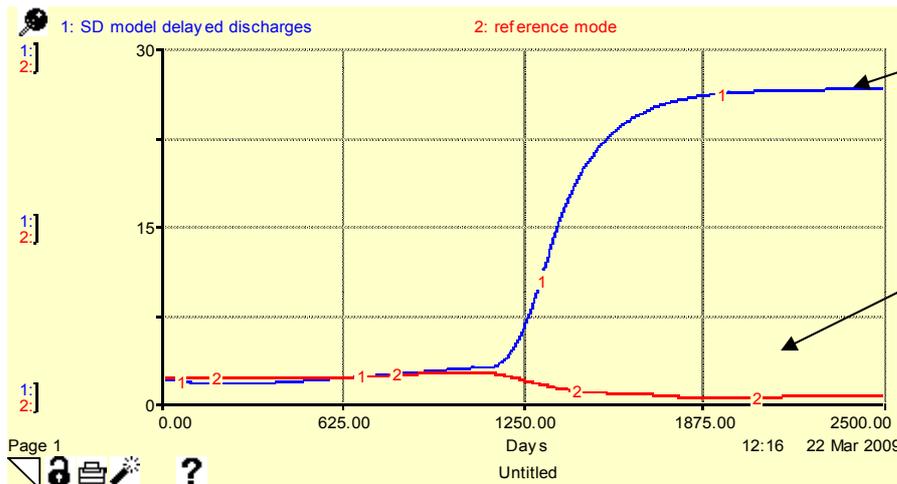


Figure 14: The effect of using an integrated information system to reduce patient delays in 2003 when patient referrals to social services are increased

Patient backlogs are able to increase more quickly increasing actual delayed discharges as more patients are referred to social services.

Testing the effect of an integrated information system policy when there is sufficient capacity levels

Information systems effect delayed discharges in a positive way when there is sufficient capacity present in the health and social care system. This is illustrated with the examples below of using integrated information systems to reduce patients’ delays and increase the accuracy of information being sent throughout the patient process.

Patient Delays and Accuracy of patient information

An integrated information system is used to reduce the time it takes for patient’s details to be sent from the NHS to Social Services, and reduce the deployment time for social services to start patient assessments. In addition the information system can be used to improve the accuracy of the information sent. This highlights key intervention points where an integrated information system can make a difference as shown in figure 15.

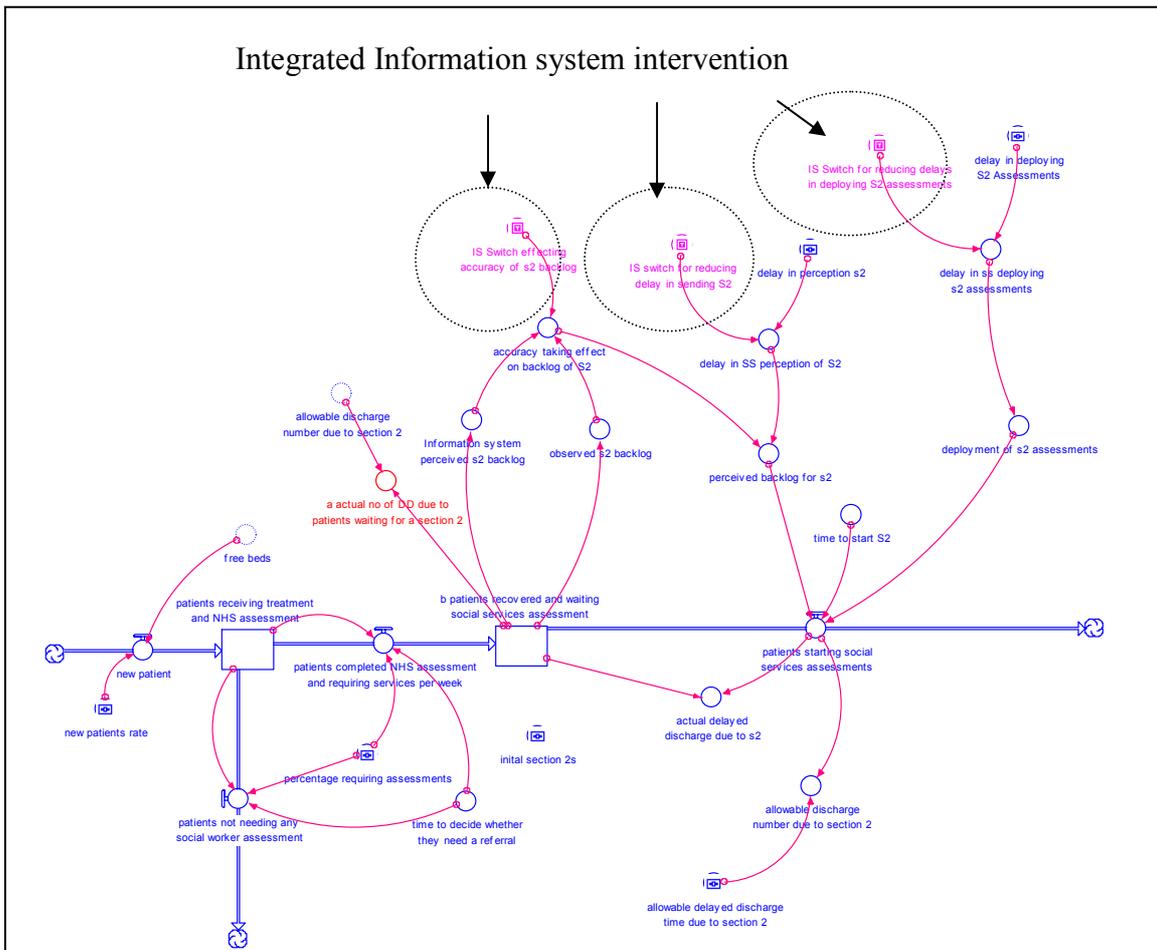


Figure 15: An illustrative example showing intervention points of where an integrated information system could make a beneficial difference in the social services and NHS patient assessment process

Policy 6 is tested against the reference mode where an integrated information system is used to reduce patient delays and deployment times of assessments to start by social services, whilst improving the accuracy of patient information being sent from the NHS to Social Services. This is in addition to the organisation’s policy 4 in 2003 of increasing all capacities. Information systems have shown to have minimal impact on delayed discharges when delays are small as shown in figure 16. However when patient delays are increased by twice as much information systems have a greater effect on reducing delayed discharges, as the accuracy of patient information is improved for a larger number of patients (see figure 17).

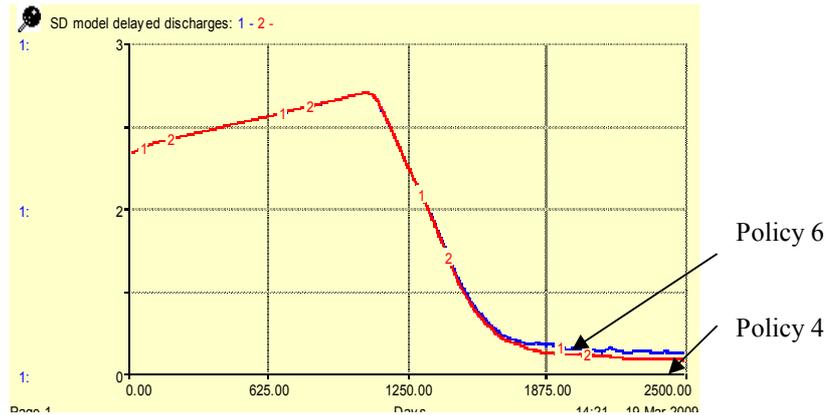


Figure 16: Delayed discharge behaviour when using integrated IS to reduce smaller patient delays and improve the accuracy of patient information

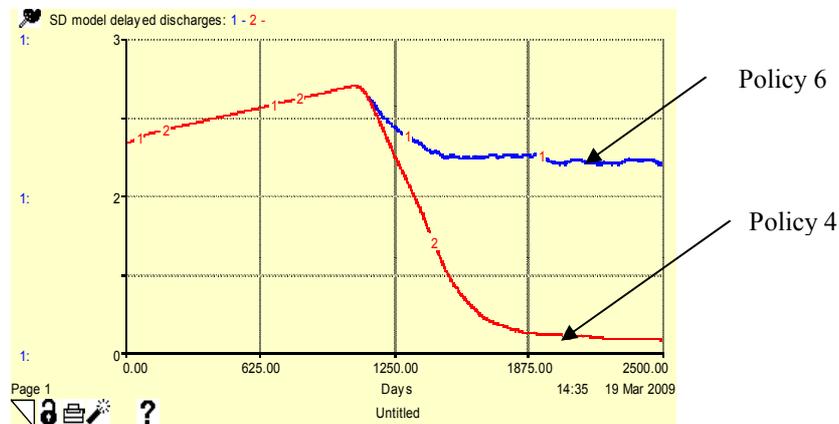


Figure 17: Delayed discharge behaviour when using integrated IS to reduce larger patient delays and improve the accuracy of patient information

There are benefits in using an integrated information system as seen with information systems being used to successfully reduce large delays and improve the accuracy of patient information in the patient process, leading to reduced delayed discharge. This is providing there is enough capacity available at different stages of the patient process.

As seen earlier, integrated information systems are not an appropriate substitute to increasing capacity in reducing delayed discharges (see figure 13). These two elements of information systems and capacity are combined to see whether information systems could be used to be more responsive to increasing capacities to reducing delayed discharges. There is a need to increase capacity along the patient process when adopting an integrated information system for the benefits of the information system to take effect when there are limited capacities. This leads onto the third step of the need to adjust existing policies to incorporate the integrated information system policy.

Adjusting existing policies to incorporate the information system policy

Information systems can be used by managers to inform them of gaps in capacity, prompting more responsive action from managers towards changing capacity levels based on the backlog of patients waiting for services, as illustrated in figure 18 below.

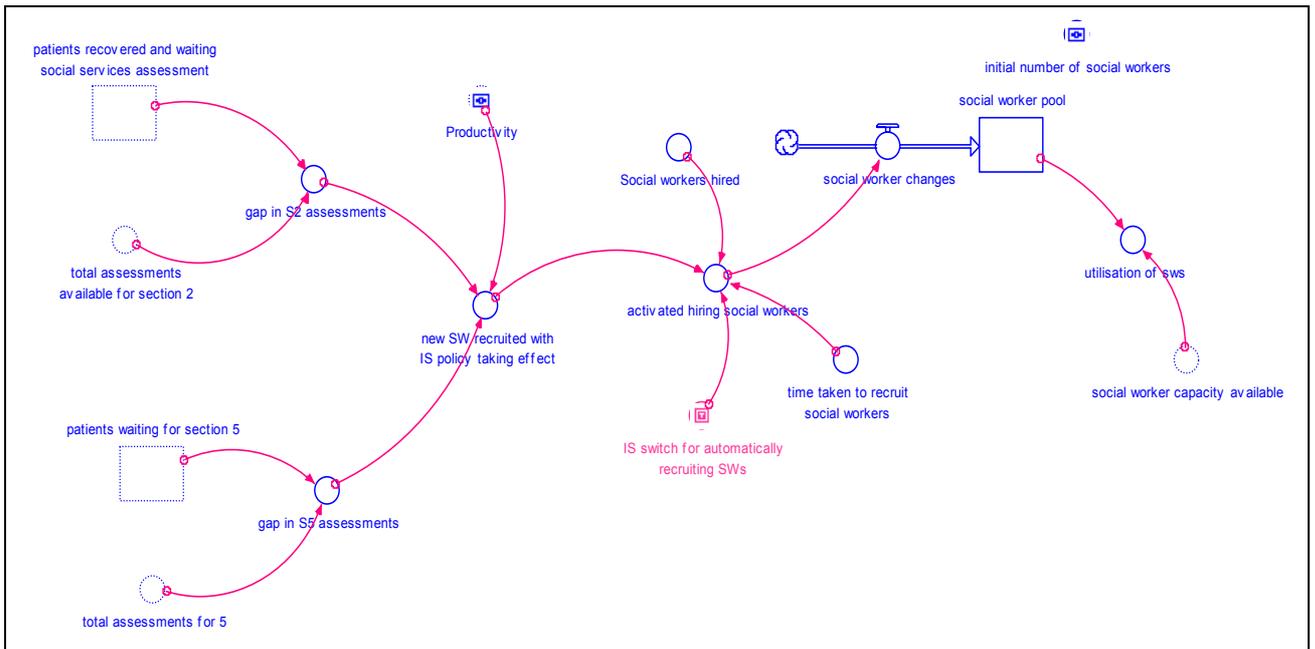


Figure 18: Using integrated information systems to inform managers of gaps in capacity levels

Based on this, policy 7 has been tested which has involved recruiting social workers using integrated information systems whilst not increasing any other capacities. This policy is tested against policies 1 and 8 to see what effect they have on delayed discharges. Policy 1 involves increasing social worker capacity by 20% from 2003 without using an information system and not increasing any other capacities, such as district nursing or post acute capacity. Policy 8 involves keeping all capacities the same in the health and social care system, and not implementing any new policies. This policy was in place at the start from 2003/4.

This includes the capacities of social workers, district nursing and post hospital capacity being kept unchanged.

It can be seen that policy 7 has the best effect on delayed discharges as social workers are recruited based on the capacity gap that exists taking into consideration the backlog of patients waiting to be assessed, rather than policy 1 of the organisation deciding to recruit social workers without full consideration of the backlog of patients (see figure 19). Policy 8 gives the highest delayed discharges since as no new capacity is added to the system the backlog of patients build up in numerous areas of the patient process, as patient numbers increase waiting for district nurses, post acute services and for assessments from social workers.

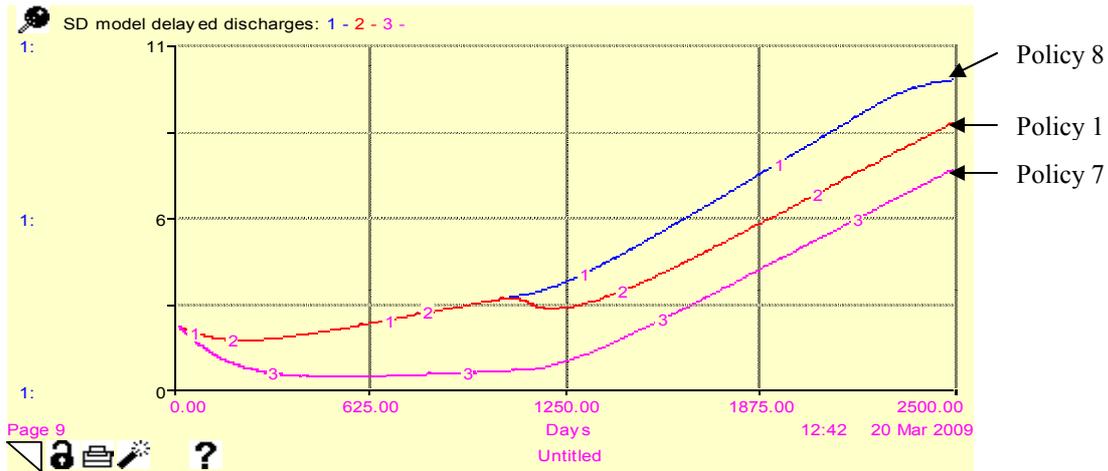


Figure 19: Testing the effect of using an information system to change social worker capacity whilst keeping all other capacities unchanged

This principle can be extended to other areas where there are capacity constraints as indicated in the policies 9 and 10. Policy 9 involves using an information system to increase social worker and district nurse capacity, but not increasing other post hospital capacities. Policy 10 involves using an information system to increase social worker, district nursing and post hospital capacities. These policies are used in the example below (see figure 20) where large patient delays are present due to the number of patients being admitted into the ward increasing from 8 to 10 patients.

These policies have been compared to policy 7 as highlighted earlier (see figure 19). Policy 7 involves recruiting social workers using information systems but not increasing other capacities. In each of these three policies integrated information systems have been used to reduce patient delays and improve the accuracy of patient information being sent.

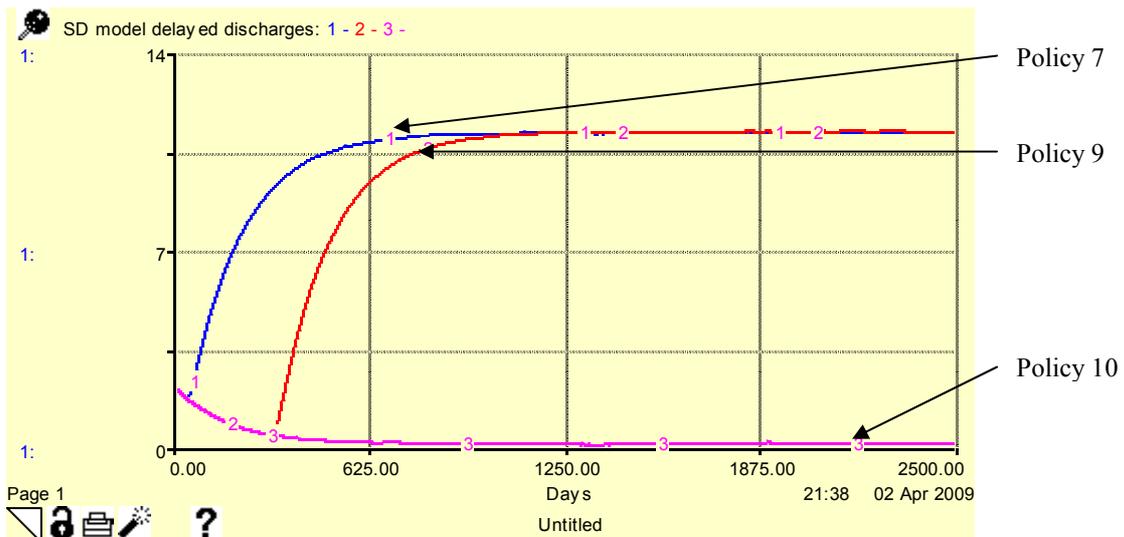


Figure 20: Investigating the effect of integrated information systems on varying different capacities with large patient delays being present

Policy 10 has the best results of lowering delayed discharges compared to policies 7 and 9 as the integrated information system is used in more areas to change capacity levels based on the backlog of patients waiting for relevant services (see figure 20). Policy 10 uses information systems to lower delayed discharges at an increased number of intervention points along the patient process, as illustrated in figure 21.

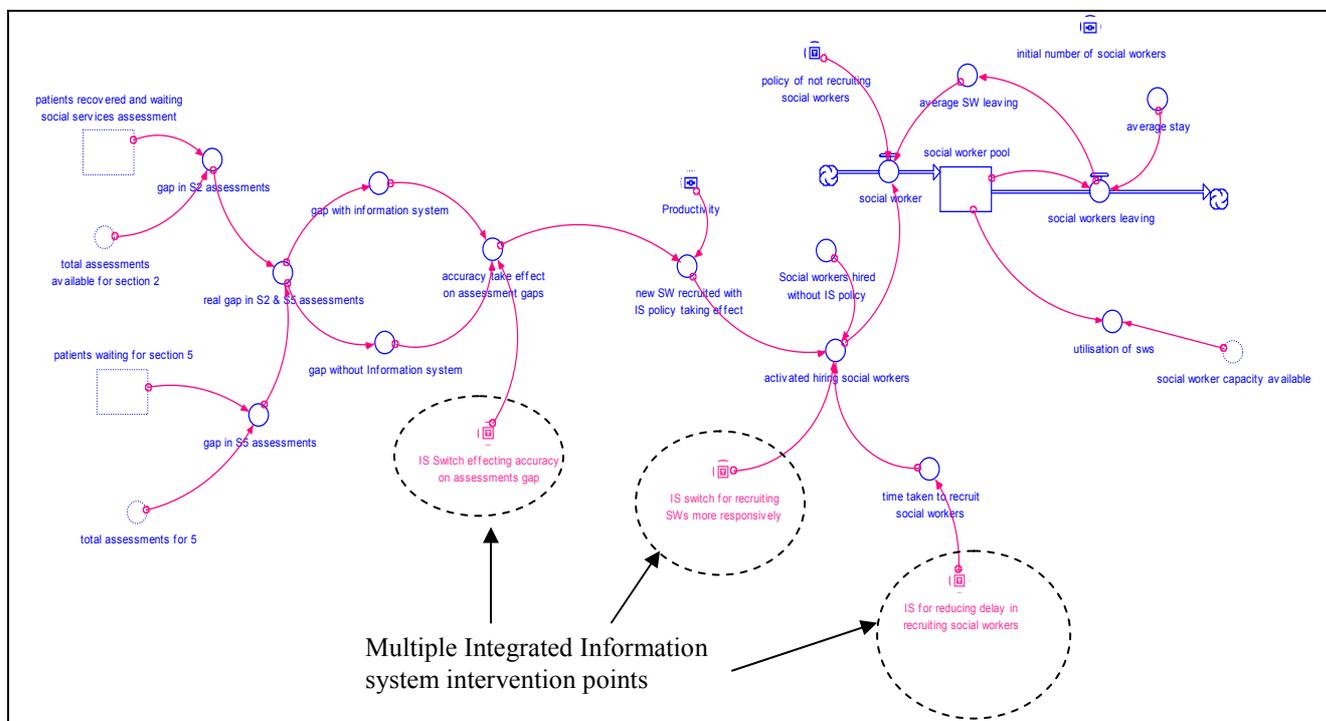


Figure 21: An example of integrated information system intervention points when recruiting social workers

Evaluation of the system dynamics model

In evaluating the model the research participants found the model to be highly useful. Nurses and social workers were able to appreciate the problems that existed in the patient process more as the model helped them to apply a more holistic view of the patient process, such as there being a lack of social workers to carry out patient assessments. In particular the model helped social workers and nurses understand each others organisational processes that were in place. Nurses were able to understand better why there were backlogs of patients waiting to be assessed by social workers. Similarly social workers were able to understand better the delays present in them receiving patient assessments from the NHS. This outcome from the evaluation of the model is extremely important, as social workers and nurses come from completely different educational and training backgrounds which have often created conflict and misunderstanding. The research has shown that the system dynamics model can play an important in reducing these misunderstandings.

Staff A3 the Hospital Discharge Process manager and A2 the Intermediate Care manager who in the earlier interviews felt that information systems do not have any value or effect on service provision had changed their perceptions of information systems. A3 replied *'I can see how useful integrated information systems can be in increasing capacities and in reducing delays. The model is useful in terms of testing*

policies, especially as we are under pressure for our policies to be more evidence based'. A1 said 'How did you learn to create the model? It does illustrate some key areas where an information system could make a difference'.

Information system managers A18 and B1 were extremely happy to see the simulation model as they often found it difficult to see the effects of implementing their information system policies, and in persuading staff to make more effective use of the information systems in place. Staff A18 commented *'The model has been helpful in showing how integrated information systems can reduce patient backlogs'*. A18 and B1 highlighted the point that integrated information system policies were only useful if staff made use of the information systems and they made sure that information being entered onto the information system was as accurate as possible. They recognised that usage of a simulation model could help encourage staff to use the information systems if the flight simulator helped staff to see the benefits of using the information systems.

Conclusion and Recommendations

There is a need to have information systems that span both the health and social care sectors. The results from the system dynamics models have indicated that an information system policy would only be useful if it simulates action when there is a lack of capacity in the health and social care system. The integrated information system can be used to increase capacities such as social workers, district nurses and post hospital capacity more responsively than would otherwise take place. An information system would not be useful as a policy on its own when there is a lack of capacity in the health and social care system.

It was shown that an information system policy on its own (when there is limited NHS and Social Services capacity) leads to increased delayed discharging. The throughput of patients through one part of the system is increased resulting in patients being blocked further down the process by limiting capacities.

From the literature review and during the application of the case study it was clear that there was a lack of understanding by stakeholders as to the effects separate and integrated information systems have on service provision. However usage of the flight simulator by health and social care stakeholders showed stakeholders gaining a useful insight into the effects of information systems on delayed discharging. In some cases the simulation model was powerful in changing stakeholders' perceptions of how an integrated information system affected delayed discharging. The perceptions were changed from staff thinking that integrated information systems have no affect on service provision to them seeing the effects of information systems on delayed discharging of patients and them being convinced of the benefits of information systems towards service provision.

This paper asserts that although information systems will not eradicate all health and social care organisational problems, information systems will make a significant beneficial difference to the way in which organisations operate.

This study has aimed to increase the body of knowledge in this area as it has gathered the experiences of stakeholders as to what they think are the effects of information systems, and has modelled the effects of integrated information systems on delayed

discharging in elderly care. This study has involved a period of time when there has been more advanced organisational integration between the NHS and Social Services and when no other study has modelled the effects of information systems between the NHS and Social Services. The study has provided an evidence based approach as to what policies are best for the health and social care system concerned.

A policy recommendation to health and social care managers would be to use integrated information systems to help inform them of what capacity adjustments need to be made to social workers, district nurses and other post hospital services to reduce patient backlogs. This will enable the organisation to be more responsive to patients waiting for services within the NHS and social services.

Areas for further research

Further research could involve expanding the model to look at how integrated information systems could be used to affect the other internal levers that drive the system, as highlighted earlier. For example in looking at how integrated information systems can be used to increase social worker productivity.

Given the value that emerged from usage of the simulation model by health and social care stakeholders it is recommended that further research be carried out on the usage of the model as a flight simulator to other local authorities and NHS Trusts. In addition the simulation model should be extended as a learning tool to students both on health, social care and management related courses.

The research could be applied to other areas of the health and social care sector. It would be useful to compare the information system experiences of NHS nurses and social workers from this study to other areas of the hospital department or social services department.

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