Dynamic Health Care Decisions and Child Health in South Africa[1]

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Dynamic Health Care Decisions and Child Health in South Africa*

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Abstract

A large number of child deaths in developing countries could be averted if ill children received care sooner rather than later. This paper analyses the healthcare treatment pathway that is followed for children under the age of six. The majority of these children receive treatment within 24 hours. However, we find that income affects the probability of any treatment, despite freely available public healthcare, while delayed treatment for severely ill children is more likely to occur in more expensive private facilities. Our results suggest that free public healthcare is not enough to mitigate health inequality amongst young children, and that delayed healthcare could lead to adverse household expenditure shocks.

JEL: I12, D13, C35

1 Introduction

Despite heavy public investment and global health care initiatives, high child morbidity and mortality is still prominent in developing countries, and the illnesses behind the observed morbidity and mortality are largely preventable.[1] The United Nations Children's Fund (UNICEF, 2007) estimates that as many as half of all child deaths could be averted through inexpensive health practices, including better child healthcare decision-making. Terra de Souza, Peterson, Andrade et al (2000) find that poor and/or delayed health-seeking for children contributes up to 70% of child death; however, ensuring prompt and appropriate care-seeking is one of the practices for which there is the least health policy intervention experience (Hill, Kendall, Arthur et al, 2001). Given that most children survive into adulthood, prompt and better health care decisions or other investments into child health are likely to have effects beyond averting childhood mortality and morbidity. Adler, Boyce, Chesney et al (1994), Case, Lubotsky and Paxson (2002) and Case, Fertig and Paxson (2005), for example, show that low levels of child health investments have far-reaching negative consequences to social, educational, economic, and health outputs for those children upon reaching adulthood.

One investment of particular relevance to this research is the set of decisions made on behalf of children, who depend on adult caregivers, typically parents, to act in their best interests. In other

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[1]Infant and childhood mortality rates, caused largely by infectious diseases, particularly Acute Respiratory Infections (ARI) and diarrhoea, are still as high as 91 per 1000 in developing countries, Wagstaff, Bustreo, Bryce et al (2004).

words, adult caregivers and the constraints they face within their household and family structures will strongly influence child health outcomes.[2] As noted by Jacobsen (2000), the household does not only demand and consume health care; the household is also an important producer of prevention, health care and health, in general. In considering health care, whether or not to use health services is a choice households often have to make. Regardless of the nature of the health care need, Pokhrel and Sauberborn (2004) suggest that health care decisions are complex processes involving several steps that are not an end in themselves; instead, as has been further argued by Cardol, Groenewegen, De Bakker et al (2005) and Ha, Burman and Larson (2002), these complex decision processes are influenced by various, sometimes independent and sometimes interwoven, factors.

In this paper, we examine a pathway model of health-seeking behaviour for children under the age of six, where the behavioural decisions are likely to be driven by adult caregivers, as well as household resource and structure constraints. The analysis is set within a sequence of health-seeking behavioural events, from detection of child illness, to the decision to seek treatment (either immediately or later), to the facility sought for treatment, similar to that suggested by Kroeger (1983), Pokhrel et al (2004) and Pokhrel, Snow, Dong et al (2005). However, instead of assuming independence from one decision to the next, we allow for the empirical conditioning of previous outcomes on the current decision. A nested model of the decision process, based on inverse probability weighting to account for conditionality, is applied to World Health Survey (WHS) data collected in South Africa in 2002 (WHS, 2003) to estimate our pathway model. The empirical exposition discerns the effect of structures (e.g., caregiver marital status and household size), household resource constraints and illness severity on the timing of health-seeking decisions, following the initial observation of a child's illness, providing policy relevant information with regard to the timing of treatment and factors affecting both treatment timing and facility choice, conditioned on that timing.

In South Africa, in an effort to reduce health inequalities tied to income inequalities, public healthcare for children under the age of six is available for free. Therefore, we would expect that income would not affect child treatment decisions. However, our results show that the poorest children are still the least likely to be treated, suggesting that public health policy could still do more for the poorest children. We also find that the severity of illness is an important determinant for the receipt of care for these children. Furthermore, the severity of illness for children that have not received immediate treatment is a strong predictor of private health facility usage, implying that households do not hold much faith in the public health sector's ability to improve the health of the most severely ill children. Also, the delay associated with seeking private care for the most severely ill children implies large household expenditure shocks, which may create further inequalities across households unless these shocks can be mitigated through other avenues, such as social insurance.

The rest of the paper is organized as follows. We continue, in Section 2, by describing the pathway model that we use in the analysis. Section 3 describes the data used in the analysis. The results of the analysis are presented in Section 4, while Section 5 concludes, considering policy related concerns and potential avenues of future research.

2 Empirical Methodology

Among the several models for explaining health seeking behaviour and its surrounding complexity, two basic approaches have been identified. Kroeger (1983) distinguishes these two approaches as the pathway model and the determinants model. The pathway model assumes a logical sequence of steps, e.g., decisions are taken from the earliest symptoms through to the decision to use health care services, as well as which type of service. The pathway model or "illness career" approach has its roots in medical sociology and anthropology, and, as its name implies, represents a dynamic process.[3] A

[2] The family holds the primary responsibility for the protection, upbringing and development of children who are entitled to receive comprehensive protection and support, UNICEF (2001)

[3] Pescosolido (1992) defines the "illness career" as the sequence of actions surrounding the rectification of a health problem.

number of qualitative methodological approaches have modeled the health care utilization decision-making process by elaborating on patient action and interaction, as well as the stages or pathways that result in facility contact.[4] However, quantitative evidence underpinning the aforementioned qualitative decision process has been sparse. The determinants model, on the other hand, focuses on variables explaining preferred health care service choices, and tends to be a static analysis focusing on one particular decision within the decision-making process. Current empirical literature has identified some demand (e.g, family headship, age, gender of family head, employment status and education level of the parent, availability of social protection, quality of the services and income) and supply (e.g., prices and health facility characteristics) factors that affect decisions to utilize health facilities.[5] Salgado De Snyder, Diaz-Perez, Maldonando et al (1998), however, note that most quantitative research on health-seeking behaviour has focused on identifying and describing the barriers to health services utilization as the end-point of the analysis, and, thus, failed to offer empirical evidence at any decision node along the pathway, except at the final health services contact node.

2.1 *Discussion*

In this analysis, we consider only households with young children, and the pathway surrounding healthcare decisions for those children. The pathway model assumes that decisions regarding child health care are dynamic in nature and influenced by household characteristics, especially the involvement of the parents. The importance of parental resources, behaviour and household structure on a child's health is evident in the large differences that exist in children's health outcomes.[6] The young children in the household may or may not become sick at any point in time. Importantly, though, if the child becomes ill, someone in the household will need to identify that the child is ill, thus placing the child in an 'illness career'. Once an illness has been observed, the caretaker in the household must then determine an action; presumably, the caretaker decides either to seek treatment immediately for the child or to wait to see if the symptoms become worse. If immediate treatment is chosen, the caretaker will also need to determine whether to seek treatment through a private or a public facility. On the other hand, if the caretaker decided to wait, initially, then, at a later stage, the caretaker will once again be required to determine if care should be sought outside the home, and, if so, whether care should be sought at a public or private facility. Therefore, not seeking treatment for the sick child results from not having previously chosen to treat the child.

The perception or recognition of illness is the first important stage in the sequence of health care. According to Suchman (1965), problem identification occurs at this stage and without that identification no health care would be sought. Perez-Cuevas, Guiscafre, Romero et al (1996), Bojajil, Kirkwood, Bobak et al (2002) and Pokhrel et al (2004) have all identified symptom recognition and perception as a barrier to care-seeking.[7] However, in order to place the child in an "illness career", the child must be accepted in the sick role. Acceptance into this role depends primarily upon maternal recognition of certain signs and symptoms of child illness, such as illness severity.[8]

[4] Suchman (1965) was first to describe the process of illness behaviour as a logical sequence of steps, beginning with the perception and evaluation of symptoms and concluding with the use of different health facilities.

[5] Ensuring the availability of essential supplies, equipment and medication is a necessary requirement for good quality health care. However, child survival, growth and development depend not only on the food intake and health but also on caregiver behaviours, Engle, Menon and Haddad (1997).

[6] Lindelow (2004) found that a biological child of the head of the household is more likely to be immunized. Similarly, Astone and McLanahan (1991) found that children receive less parental time and attention in single parent families. While, Coreil (1983) observed, in the case of rural Haiti, that the opportunity cost of taking children to health facilities is greatest in single-adult households.

[7] Pokhrel et al (2004) indicate that differential child mortality in Nepal may be due to differential health care access arising primarily from illness perception, not necessarily from the decisions to seek care or spend money on sick children.

[8] Teerawichitchainan and Phillips (2008), in their multinomial logit study of Vietnamese data, discovered that child sex, ethnicity, the number of siblings and maternal education are important determinants of reported illness.

Another set of steps in the health decision trajectory is tied into investments in health recovery, either through the consultation of an external health worker or through natural recovery and the timing of that investment. Thus, the household is assumed, at this stage, to make a complex decision that is revealed through the timing of their health-seeking behaviours. The decision is assumed to be consistent with its utility maximization objective, subject to the household budget constraint; however, it is likely to be quite dynamic, even at this stage. It is also reasonable to assume that caretakers confront a series of binary (treat/no treat) decisions.[9] However, in our data, it is only possible to see if care is sought within 24 hours or after 24 hours. Therefore, we abstract from this series of intermittent decisions, focusing only upon the outcomes that can be identified in the data: immediate treatment (within 24 hours), delayed treatment (after at least 24 hours), or no treatment (resulting from infinite, with respect to the illness symptoms, delay). This series of steps in the decision trajectory, however, is important, since a number of childhood diseases leading to death could be reduced if appropriate treatment was given in a timely manner.[10]

The medical care contact stage is the final leg of the path to be modeled; in a wide variety of analyses, it is the only step in the path to be considered.[11] Households are assumed to make use of a knowledgeable health care provider from either the public or private sector. Although this is the last stage of the household analysis in our model, due to data considerations, it is likely that the healthcare provider will present additional decisions related to treatment and treatment compliance (Homedes and Ugalde, 2001; Fadil, Alrahman, Cousens et al, 2003).

2.2 *The Model*

Assumed in the preceding discussion of caretaker decisions, therefore, is a sequential process with five distinct nodes: (A) observe illness, (B) given an observed illness, treat immediately, (C) given both illness and immediate treatment, determine facility for treatment, (D) given illness, but not immediate treatment, determine if any treatment is needed at all, (E) given illness and later treatment, determine facility for that treatment. This decision process is illustrated in Figure 1, along with the number of children in each cell from the WHS-South Africa dataset.

For discussion and analysis purposes, we will assume that illnesses are random events, such that treatment and facility choices do not determine whether or not a child is observed to be ill.[12] Therefore, nodes (B)–(E) are sequentially independent from node (A). For the econometrician, a number of modeling choices for outcomes (B)–(E) are plausible, given various assumptions about the data, the unobserved factors, and the decision process undertaken by the caregiver. The outcomes or decisions made at each node could be modeled as a simultaneous process or as part of a sequential process. Assuming simultaneity, one could model the outcomes as a multinomial logit (MNL), assuming that the error terms were Type I extreme valued. However, the error terms are assumed to be independent of irrelevant alternatives (IIA) in the MNL, and, therefore, it is often preferable to consider a nested logit (NL) model, that relaxes the IIA assumption.[13] Given the structure of the data, which provides a dynamic context to the outcomes, the MNL is unlikely to fit the context. In a sequential logit model (SL), on the other hand, each decision is assumed to be independent of the preceding decisions.[14] Even though each decision must be independent, at

[9] For example, they may wait until the morning to see if there are signs of improvement. In the morning, they may decide to wait a bit longer.

[10] Bojalil et al (2002) and Hill et al (2003) focus upon the potential reduction in deaths that could result amongst both the large number of children who die in developing countries without reaching a health facility, and the large number who die shortly after arrival at healthcare facilities if treatment delay were reduced.

[11] See, for example, Grobler and Stuart (2007), Bolduc, LaCroix and Muller (1996) and Dor, Gertler and Van der Gaag (1987) for Africa specific examples of health facility choice focusing specifically on a single component of the decision tree.

[12] The WHO survey only focuses upon the youngest child in the household, assuming that the child is no more than five years of age. Therefore, the plausibility that illnesses are clustered within households cannot be considered.

[13] Other models, such as mixed models, could also be used to relax the IIA assumption of the MNL.

[14] The SL is similar in character to a two-part model, also referred to as a hurdle model, such as that discussed by

least from a duration perspective, it is also true that the econometrician cannot observe all the factors affecting each decision, and, therefore, unobserved factors could be correlated through the sequence of decisions. If unobserved factors are correlated through the decision sequence, sample selection might be a problem, requiring corrections similar to those proposed by Heckman (1979), requiring strict assumptions on the structural form of the error correlation. Furthermore, since there are a number of steps in the decision process, and different selection criteria may apply at different point along the decision tree, a more nuanced approach to controlling for selection has merit. Correcting for sample selection, though, requires exclusion restrictions, which are not often available in cross-section data.

Therefore, we model selection by applying inverse probability weighting, as suggested by Woodridge (2002). This method is similar to propensity score matching, as widely applied in the literature.[15] Importantly, selection is confined to variables that are observable to the econometrician. The subsequent selected observations are reweighted to account for the probability of being observed, and the resulting standard errors are conservative, in the sense that second stage standard errors do not need to be corrected, Wooldridge (2002).

Formally define $y_{ij} = \{0,1\}$for each child i and the outcome observed at decision node $j = \{B, C, D, E\}$.[16] As described above, each child will have an outcome for $j = A$; however, only children observed ill at node A will have an outcome for nodes j. Defining the probability of a positive outcome as $p_j = E_j\left(y_j = 1 \left| x_j, -1, j-2, \ldots, 1\right.\right)$ - which depends on the path of decisions – we can estimate this probability via equation (1).[17]

$$p_j = F_j\left(x_j\beta_{j,}\varepsilon_j \left| j-1, j-2, \ldots, 1\right.\right) \tag{1}$$

In this analysis, we model F_j as linear in its arguments, and we model ε_j as a Type I extreme-valued error term, such that logit regression can be applied.

As implied by (1), each probability depends upon the path of preceding decisions. If those preceding decisions are correlated with , it is necessary to account for that correlation, which we do through the inclusion of inverse probability weights. Given the structure assumed in the decision process, facility choice, given immediate treatment, is independent of facility choice, given delayed treatment; therefore, we do not weight according to the predicted probability of immediate public treatment in the delayed public treatment model. Furthermore, given the assumption that illnesses are random, we do not worry about the probability of illness in the subsequent decision processes. The resulting estimated equations are:

$$\begin{aligned}
p_B &= F_B\left(x_B\beta_B, \varepsilon_B\right) \\
p_C &= F_C\left(x_C\beta_C, \varepsilon_C \left| \hat{p}_B^{-1}\right.\right) \\
p_D &= F_D\left(x_D\beta_D, \varepsilon_D \left| \left(1-\hat{p}_B\right)^{-1}\right.\right) \\
p_E &= F_E\left(x_E\beta_E, \varepsilon_E \left| \hat{p}_C^{-1}\cdot\left(1-\hat{p}_B\right)^{-1}\right.\right)
\end{aligned} \tag{2}$$

As implied in the preceding equations (2), the determining variables are allowed to be different, such that exclusion restrictions could be accommodated. However, in this analysis, given the lack of suitable exclusion restrictions, we assume that selection is driven by observed values, and, therefore, the determinants will be the same in each regression.

Tobin (1958) and Mullahy (1986), although in this example there are far more than two parts to the analysis, and the following outcomes are binary.

[15] Imbens and Wooldridge (2009) provide an excellent survey of the wide applications in the literature, including inverse probability weighting

[16] Unless otherwise necessary, we drop child-specific subscripts for ease of exposition.

[17] For further ease of exposition, we do not describe our model in terms of an underlying random utility model, given how ubiquitous that description is in the literature. McFadden (1974), amongst many others, provides a more formal derivation.

3 Data and Analysis Variables

3.1 *The WHS*

The data for this study is taken from the South African portion of the WHS carried out in 70 countries during 2002-3; the South African survey was conducted in 2002. The survey was developed and implemented by the World Health Organization, in order to compile valid, reliable and comparable comprehensive information on the health of the population and on the outcomes associated with investments in various national health systems, Üstün, Chatterji, Villanueva et al (2001). The survey is primarily designed to develop an evidence-based dataset to monitor whether health systems are achieving their desired goals, as well as to provide the evidence base that policymakers need to improve their policies, strategies and programs, WHS (2003).[18]

Wagner, Reiss, Johnson et al (2007) judged the overall quality of the data to be satisfactory for any quantitative analysis that could be considered. Obermeyer, Murray and Gakidou (2008) also found the data to be representative in their analysis of violent war deaths from Vietnam to Bosnia. In addition to cross-country studies, the data has also been used, albeit in limited instances, to focus on specific countries, like South Africa.[19] Based on the reliability of the WHS data observed by previous researchers, our analysis makes use of the WHS 2002 South Africa Survey, which consists of 2345 households and 10500 individuals. However, the WHS does have its limitations. The main one being that the econometric analysis is applied on a reduced sample, since there is only one surveyed child under the age of five in any household, due to the design of the instrument. The final analysis dataset consisted of 520 households. In 342 of them, illnesses were observed in the children; however, complete independent data were available for only 332.

Despite the limited number of observations, negative health events are observed for nearly two-thirds of the children, and these include observations of fever, coughing, diarrhea, vomiting and many other common afflictions; see Table 1 for a more detailed description. In addition to these negative health events, this data allows us to consider the timing associated with illness treatments, one of the few data sets allowing for such analysis. The data also contains detailed socioeconomic information on the household, including household expenditure on health (unfortunately not specifically for the negative child health event analyzed) and the child's health insurance coverage status. Although there are a limited number of observations, significant estimates are obtained for many variables. We can also be sure that significant results are not merely driven by the size of the dataset, and, therefore, policy recommendations are likely to be quite robust, even in our small sample.

3.2 *Analysis Variables*

The empirical model assumes that households maximize utility by following the optimal healthcare pathway, for the sake of children under the age of five; therefore, the empirical specification includes various socioeconomic and demographic characteristics of the household. Previous studies suggest that parents pay closer attention to their own children than the children of others.[20] Therefore, we control for both single-parent households and whether or not the child lives with their biological parent. Economically, we also expect family income and access to insurance coverage to affect household health decisions. As shown by Anyanwu (2007), Dong, Gbangou, De Allegri et al (2008) as well as Novignon and Aglobitse (2008), income is a strong predictor of facility choice in developing countries. Although access to household income is likely to be important, insurance cover in South Africa is

[18] Data in the WHS was collected on a modular basis. The modules address different aspects of the health system and include information on health insurance, health expenditures, socio-demographics, income, health state evaluations, health system responsiveness and health system goals.

[19] Lamiraud, Booysen and Scheil-Adlung (2005) analysed the impact of social health protection on access to health care, health expenditure and impoverishment in South Africa using the WHS-South Africa data.

[20] Lindelow (2004) found that children were more likely to be immunized, if living with their parents. Similarly, Astone and McLanahan (1991) found that children in single parent families received less parental time, while Coreil (1983) observed that the opportunity cost of taking children to health facilities was greater in single parent households.

strongly correlated with income, although insurance cover is primarily determined by employment, which limits concerns over the simultaneity of both income and insurance. Notably, only 15% of the children in our data are covered by insurance, further limiting worries over simultaneity. In this analysis, we include non-linear measures of income – expenditure quartiles are used as a proxy for income quartiles – and insurance coverage.[21] We also include categorical measures of family size to account for additional household resource constraints. Medically, we expect that illness severity is an important factor in health-seeking behaviour. Although severity is not directly measured, we control for this by including categorical counts of the number of reported symptoms related to the child's observed illness.

4 The Results

Before turning to the empirical analysis, we provide a brief discussion of the data that is used in this analysis. Those descriptive statistics and data definitions are presented in Table 1. Nearly 66% of the children under age five have been reported ill, yet only a fraction more than 15% are covered by a South African medical scheme (health insurance policy). The number of symptoms reported for the child's most recent illness is nearly equally split between one, two, three and four or more. These children tend to live with their biological parents (62%), and the head of their household is normally married (61%). Average household expenditure was R1 389 per month (approximately US$133.25 in 2002), while the average household exceeded six individuals. Of the children reported ill, about 20% were not treated, 53% were treated immediately, while the remainder were treated after some delay. The majority of treated children received their treatment from a public facility – 70% if treated immediately and 61% if treated after some delay.

4.1 *Treatment Timing*

The first set of empirical results, reported for treatment timing, are presented in Table 2. This table contains both the coefficient estimates and the marginal effects for each of the treatment options, according to timing of decision: immediate treatment versus later or no treatment and delayed treatment compared to no treatment, conditional on not having received treatment to that point.[22] In the first two columns, coefficient and marginal effects estimates for the immediacy of treatment are presented, while the estimates for choice of treatment (or not) following some delay are in the final two columns.

Immediate treatment is more likely for children in the 3^{rd} expenditure quartile, about 13.8% more likely. Although children living in more traditional households, in which the household head is married, have a 14.6% higher probability of receiving immediate treatment, that drops by 19.7% if the household is smaller than average, and by 29.8% if the household is approximately average sized. In other words, a single child in a two-parent household is about 5% less likely to receive immediate care, as the household size effect dominates the dual parent effect. On the other hand, one medically encouraging result is that the immediacy of treatment is driven by the observation of a large number of symptoms – observing more than three symptoms results in a 21.9% increase in the probability of immediate treatment. Treatment timing (immediate or not) does not appear to be strongly influenced by either income or insurance cover, although children in the third quartile of expenditure are 13.8% more likely to receive immediate care. Instead, immediacy is associated with both symptoms and the availability of additional household members capable of either taking the child for care or watching over the household.

[21] Spearman correlations between income quartile, from lowest to highest, and insurance cover were -0.02, -0.07, -0.05 and 0.13, respectively.

[22] All explanatory variables are dummy variables; therefore, marginal effects are calculated as the difference in predicted probability between the two possible values for the indicator, one or zero.

Just under half (see Table 1) of the sick children do not receive immediate care. If these children were not treated immediately, they could be treated later. In the second stage of the analysis, we consider delayed treatment, which can only be observed for children that were not immediately treated. Assuming selection on observable values, we reweight the data for the immediately untreated individuals, or all of the children remaining in the subsample, according to the inverse of their predicted probabilities of not being immediately treated.[23] The results indicate that male children that were not immediately treated have a lower probability (15.3%) of being treated, after a delay. However, children living with a biological parent have a 31.3% higher probability of being treated after a delay than not being treated at all (given that they were not immediately treated). As with immediate treatment, the number of observed symptoms plays a role in determining whether or not treatment is, in the end, sought. Children with at least three and with three or more observed symptoms are 21.7% and 23.8%, respectively, more likely to be treated than not, conditional on not having received immediate care. More tellingly, income, as measured by expenditure, plays an important role in the probability that a child does receive at least some treatment. Conditional delayed treatment is 24.0% more likely for children in the second quartile and 25.5% more likely for children in the fourth quartile of the expenditure distribution. Once again, insurance coverage does not affect the timing of treatment.

Combining the preceding results, it is notable that children living in households in the lowest quartile of the expenditure distribution are the least likely to receive any treatment, and that is despite the fact that all children under the age of 6 are eligible for free public health care in South Africa. On the other hand, it does appear that children with more severe illnesses are receiving care. Children with more than three illness symptoms are more likely to be treated immediately, and if they were not treated immediately, they are also more likely to be treated after a period of delay. Below, we consider the estimates for facility choice conditional on treatment timing.

4.2 *Facility Choice*

In Table 3, facility choice logit estimates are presented. Importantly, these results are conditioned on the timing of treatment. In the first two columns, facility choice is conditioned on immediate treatment, while in the final two columns facility choice is conditioned on both treatment that was not immediate and treatment after delay.[24] Interestingly, despite the fact that male children were least likely to receive any treatment, they are more likely to receive immediate treatment at a private facility than are female children, 16.5% more likely. More strikingly, though, is the importance of insurance cover. Insurance coverage leads to a 45% decrease in the probability of treatment at a public facility, conditional on immediate treatment. The effect of income is more nuanced. As previously noted, children in the third quartile are more likely to receive immediate treatment, and, conditioning on immediate treatment, they are 24.7% less likely to be treated at a public facility. In other words, children in the third quartile are more likely to be treated immediately in a private facility. There is some evidence that children in the highest quartile are more likely to be treated in private facilities, as well.[25]

The choice of facility for children treated after a period of delay reveals the limitations of the small sample sizes, through relatively large standard errors. However, two results are significant, and one of these has particular policy relevance. First, children living in households, in which the head is married, are 24.7% less likely to receive their delayed care in public facilities. Second is the estimate that children with relatively more severe illnesses, as measured by having more than three symptoms,

[23] As noted above, this is similar in spirit to propensity score matching or selection on observables. The advantage to inverse probability weighting is that resulting t-stats are conservative, such that standard error corrections are not necessary, Wooldridge (2002).

[24] In other words, conditioning on immediate treatment, facility choice logits are inversely weighted by the probability of immediate treatment, while conditioning on delayed treatment requires weighting on the inverse of two outcome probabilities: not being treated immediately and being treated after a period of delay.

[25] Although the marginal effect is large (22.8%), it is not estimated with enough precision to be significant.

are more likely to be treated in private facilities. Conditional on receiving delayed treatment, they are 33.8% less likely to be treated in public facilities. These results highlight the potential for large adverse health related expenditure shocks at the household level. Delaying treatment, when a child is severely ill, may require large out-of-pocket expenditures to cover treatment at private facilities.[26]

5 Conclusions and Policy Recommendations

The analysis in this paper has considered the treatment pathway of children, under the age of five, who have been identified as being ill to provide further understanding of the timing of treatment for young children. As noted at the outset, delayed treatment has been attributed to unnecessary child deaths, Terra de Souza et al (2000). The analysis extends the work of Kroeger (1983) and Pokhrel at al (2004, 2005) in two ways. First, since it is possible to observe the dynamics of healthcare decisions in the 2002 WHS – South Africa data, these dynamics are modeled in the analysis. Second, the analysis does not assume that each decision is independent of previous decisions, as was done by Pokhrel et al (2004, 2005). Instead, each treatment decision is placed within a conditional pathway model, allowing the decisions from the previous stage to affect current choices. In the analysis, we find that income affects treatment decisions non-linearly. Children in the poorest households are least likely to receive any treatment, despite the fact that public health care for children under six – all children in our sample are under the age of six – is free in South Africa. We also find that insurance coverage primarily determines treatment choice for children who are immediately treated, and that they are most likely to be treated in private facilities. Furthermore, our results point to the importance of the perceived severity of illness. Children with three or more symptoms of illness are more likely to be treated. They are more likely to be treated immediately, and they are more likely to be treated after some delay, if they were not treated immediately. More worrying, however, is that children with multiple symptoms, but were not treated immediately, are much more likely to be treated at a private facility.

In terms of income and health policy, our results raise a few concerns. The first is the lack of treatment received by the poorest children. Despite the fact that public health care is free for all children in our sample, the poorest children are less likely to be treated. We interpret those results to mean that the poorest households face further constraints, in addition to facility user fees, when trying to access healthcare for their children. Although further research is necessary, it is possible that transport costs are too much for these households to bear. In that case, policymakers would need to consider finding ways to either bring healthcare to these children or, otherwise, reduce the cost of getting these children to a healthcare facility. Both mobile clinics and subsidized transport represent potential policy options. The second concern is based on the increased probability that severely ill children are receiving their care at private facilities. Although there are a number of potential interpretations for this observation, we will focus on a few that should worry policymakers. Delay in treatment, as noted at the outset, may result in poorer health outcomes for these children, possibly leading to poorer life outcomes. Therefore, one of goal of health policy is to work towards reducing delay. In terms of policy, although our research cannot address this directly, providing more education, related to the importance of early treatment, could help. Another interpretation of these findings is that household decision-makers have little faith in the public sector's ability to deliver quality healthcare, suggesting that health policymakers need to work harder to improve the quality and responsiveness of the public healthcare system. Finally, if household decision-makers are forced to spend money out-of-pocket to make use of private facilities for their severely ill children, these households may suffer adverse expenditure shocks that could have knock-on detrimental effects within the household. In that case, public policy would be better focused on the provision of social

[26] Although the data contains detailed information on health care costs, these costs include expenditures for any illness in the household, and not just for the child's illness, and, therefore it is not possible to examine the distribution of out-of-pocket expenditures for child health care, when that care is delayed.

health insurance, to alleviate these adverse expenditure shocks.

Although the dataset considered in this analysis is small, the WHS-South Africa contains extremely detailed information on a wide range of variables, including vignettes regarding equity and illness symptoms that could be used to determine the ability of household decision-makers to spot illness in either themselves or other members of the household. The key attribute of this survey, as it relates to this research, is the fact that the survey asks caregivers whether or not the sick child received their care within 24 hours, which allows us to empirically investigate both the timing of treatment and the choice of facility, conditioned on treatment timing. The survey data also provides information on health care expenditures, reasons for not seeking care and perceptions regarding the quality of care. All of this information could be used in further research to better understand the household decision-making process, although it is possible that the analysis would have to focus on qualitative analysis, given the limited number of observations for certain relevant variables. Finally, since the WHS surveys were carried out across a wide range of countries, and since the survey instruments were very similar across these countries, it is possible to use the data to paint a more detailed picture of healthcare decisions in a particular region, such as Sub-Saharan Africa.

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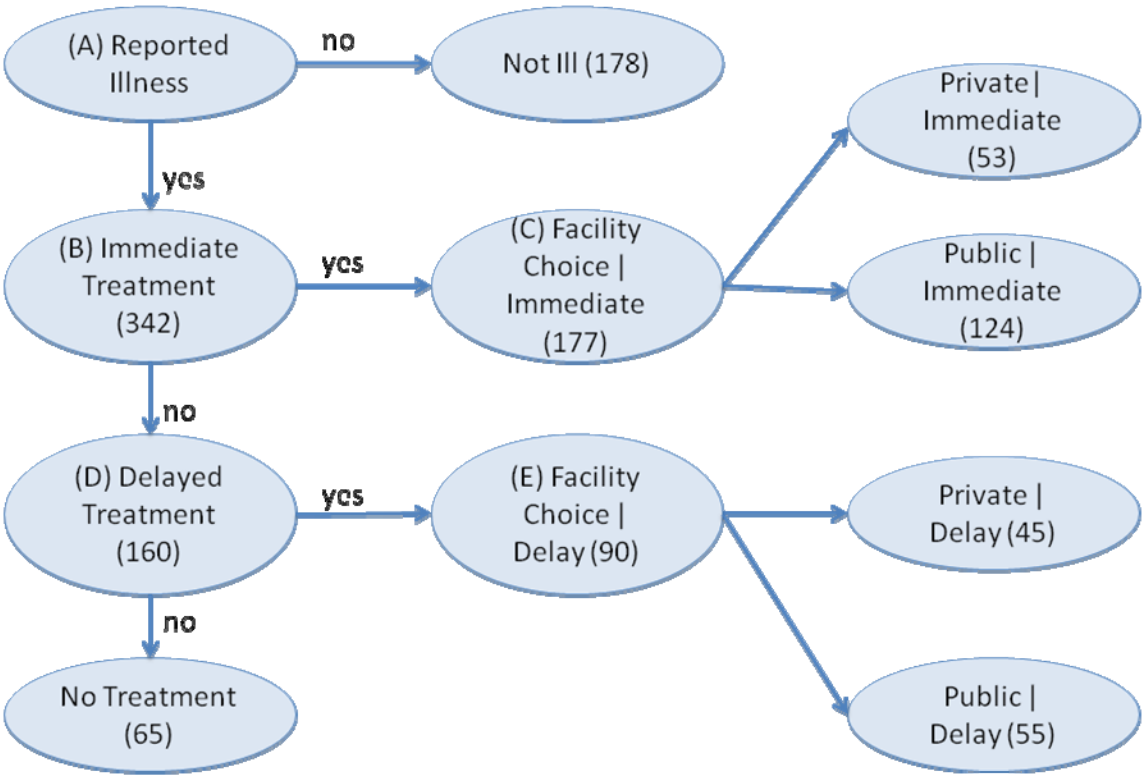

Note: Numbers in each category in parentheses. Numbers do not add up perfectly, as some observations are lost since some are not treated at either public or private facilities.

Figure 1. Illustration of Treatment Decision Tree

Table 1. Summary Statistics of Analysis Data

	Observations	Mean	SD
Child Characteristics			
Sick child (=1)	520	0.658	0.47
Male child (=1)	520	0.450	0.50
Insurance cover (=1)	520	0.154	0.36
Child lives with biological parent (= 1)	520	0.617	0.49
One reported illness symptom* (=1)	342	0.234	0.42
Two reported illness symptoms (=1)	342	0.278	0.45
Three reported illness symptoms (=1)	342	0.243	0.43
Four or more reported illness symptoms (=1)	342	0.246	0.43
Treatment			
Child treated immediately (=1)	342	0.532	0.50
Child treated after delay (=1)	342	0.278	0.44
Child not treated (=1)	342	0.190	0.39
Treatment and Facility			
Child treated immediately (Public facility = 1)	177	0.701	0.46
Child treated after delay (Public facility = 1)	90	0.611	0.49
Household Characteristics			
Married head of household (=1)	520	0.608	0.49
Expenditure: 1st Quartile (=1)	520	0.248	0.43
Expenditure: 2nd Quartile (=1)	520	0.271	0.44
Expenditure: 3rd Quartile (=1)	520	0.229	0.42
Expenditure: 4th Quartile (=1)	520	0.231	0.42
Total Expenditure	520	1389.1	2187
Four or less in household (=1)	520	0.310	0.46
Five to seven in household (=1)	520	0.435	0.50
Household Size	520	6.050	2.47

*symptoms include: fever, coughing, fast breathing, diarrhea, blood in stool, vomiting, unable to eat or drink, convulsions and other symptoms

Table 2. Treatment Logits: Immediate Treatment Conditional on Illness and Delayed Treatment Conditional on the Lack of Immediate Treatment

	Immediate Treatment or Not		Delayed Treatment or Not – Given No Immediate Treatment	
VARIABLES	Coefficients	Marginal Effects	Coefficients	Marginal Effects
Male child	-0.154	-0.038	-0.652*	-0.153*
	-0.236	-0.059	-0.393	-0.092
Biological parent	-0.056	-0.014	1.317***	0.313***
	-0.275	-0.068	-0.467	-0.106
Expenditure: 2nd Quartile	-0.258	-0.064	1.129**	0.240***
	-0.319	-0.079	-0.478	-0.091
Expenditure: 3rd Quartile	0.568*	0.138*	-0.18	-0.043
	-0.338	-0.079	-0.535	-0.129
Expenditure: 4th Quartile	0.249	0.061	1.206**	0.255**
	-0.33	-0.081	-0.59	-0.106
Household size (<4)	-0.797**	-0.197**	-0.024	-0.006
	-0.356	-0.086	-0.597	-0.141
Household size (5-7)	-1.230***	-0.298***	-0.508	-0.12
	-0.324	-0.074	-0.517	-0.121
Covered by insurance	-0.053	-0.013	0.763	0.166
	-0.32	-0.08	-0.532	-0.105
Symptoms (=2)	0.464	0.114	-0.743	-0.179
	-0.333	-0.08	-0.513	-0.124
Symptoms (=3)	0.317	0.078	1.008*	0.217**
	-0.345	-0.084	-0.546	-0.105
Symptoms (>3)	0.922***	0.219***	1.119*	0.238**
	-0.338	-0.075	-0.605	-0.11
Married Head of House	0.591**	0.146**	0.118	0.028
	-0.246	-0.06	-0.409	-0.097
Constant	0.138		-0.892	
	-0.441		-0.657	
Observations	342	342	160	160
ll	-218.2	-218.2	-88.44	-88.44

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3. Logit Estimates and Marginal Effects for Immediate and Delayed Treatment at Public Facilities

	Treatment at a Public Facility – Given Immediate Treatment		Treatment at a Public Facility – Given Delayed Treatment	
VARIABLES	Coefficients	Marginal Effects	Coefficients	Marginal Effects
Male child	0.923**	0.165**	-0.268	-0.057
	(0.413)	(0.067)	(0.615)	(0.132)
Biological parent	0.917*	0.179	-0.839	-0.166
	(0.557)	(0.114)	(0.734)	(0.132)
Expenditure: 2nd Quartile	0.012	0.002	-0.384	-0.084
	(0.706)	(0.129)	(0.737)	(0.166)
Expenditure: 3rd Quartile	-1.190**	-0.247**	0.391	0.078
	(0.560)	(0.122)	(0.937)	(0.178)
Expenditure: 4th Quartile	-1.084*	-0.223	-0.745	-0.166
	(0.635)	(0.140)	(0.717)	(0.166)
Household size (<4)	-0.408	-0.077	-0.398	-0.086
	(0.642)	(0.127)	(0.833)	(0.183)
Household size (5-7)	-0.019	-0.003	0.061	0.013
	(0.493)	(0.090)	(0.841)	(0.178)
Covered by insurance	-2.057***	-0.454***	-0.558	-0.125
	(0.551)	(0.117)	(0.719)	(0.169)
Symptoms (=2)	-0.534	-0.104	-0.008	-0.002
	(0.520)	(0.106)	(0.732)	(0.155)
Symptoms (=3)	-0.615	-0.121	-0.943	-0.214
	(0.589)	(0.124)	(0.708)	(0.168)
Symptoms (>3)	-0.050	-0.009	-1.472*	-0.338*
	(0.544)	(0.101)	(0.862)	(0.201)
Married Head of House	-0.519	-0.092	-1.401**	-0.271**
	(0.467)	(0.079)	(0.699)	(0.125)
Constant	1.773***		3.358***	
	(0.670)		(1.084)	
Observations	177	177	90	90
ll	-85.95	-85.95	-47.23	-47.23

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1