Evaluation of the effectiveness of a clinical pathway for bronchiolitis

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Abstract

Objective: This study examines the use of a clinical pathway in the management of infants hospitalised with bronchiolitis.

Study Design: A clinical pathway for the care of infants with bronchiolitis was developed from pathways used in tertiary paediatric institutions in Australia. 229 infants admitted to hospital with acute viral bronchiolitis and prospectively managed using a pathway protocol were compared with a retrospective analysis of 207 infants managed without a pathway in three regional and one tertiary hospital.

Results: There were no differences between groups in demographic factors or clinical severity. The pathway had no effect on length of stay or time in oxygen. Readmission to hospital was significantly lower in the pathway group (P = 0.001). Administration of supplemental fluids (P = 0.001) and use of steroids was lower (P = 0.005) in the pathway group. Identification of parental smoking status was higher in the pathway group (P = 0.029). Data from the pathway demonstrated that boys were three times more likely to return to oxygen after weaning to air (OR = 3.30; 95%CI 1.39 – 7.81) after adjusting for admission oxygen saturation. Documentation of variances from the pathway was misunderstood by staff.

Conclusions: A clinical pathway specifying local practice guidelines and discharge criteria can reduce the risk of readmission to hospital, the use of inappropriate therapies, and help with assessment of readiness for discharge.
Statement of Original Authorship

The work contained in this thesis has not been previously submitted for a degree or diploma at any other higher education institution. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made.

Signature:

Date:
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<tr>
<td>AIHW</td>
<td>Australian Institute of Health and Welfare</td>
</tr>
<tr>
<td>DRG</td>
<td>Diagnosis Related Group</td>
</tr>
<tr>
<td>GCH</td>
<td>Gold Coast Hospital</td>
</tr>
<tr>
<td>ICU</td>
<td>Intensive Care Unit</td>
</tr>
<tr>
<td>IV</td>
<td>Intravenous</td>
</tr>
<tr>
<td>LOS</td>
<td>Length of Stay</td>
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<tr>
<td>LMO</td>
<td>Local Medical Officer</td>
</tr>
<tr>
<td>NPA</td>
<td>Naso-pharyngeal Aspirate</td>
</tr>
<tr>
<td>RCH</td>
<td>Royal Children’s Hospital, Brisbane</td>
</tr>
<tr>
<td>RSV</td>
<td>Respiratory Syncytial Virus</td>
</tr>
<tr>
<td>TIO</td>
<td>Time in Oxygen</td>
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CHAPTER 1: INTRODUCTION

1.1 Introduction

Clinical pathways, common in many health care organisations throughout the world, are best described as planned and systematic detailing of the usual patterns of care for a patient with a specific disease or diagnosis. Clinical pathways are paths that health professionals can follow that should enable them to provide the best possible outcomes for the patient, the health care team, and the health care organisation. De Luc (2000) describes them in this way: “a pathway amalgamates all the anticipated elements of care and treatment for a particular condition or disease. It forms the actual clinical documentation and often takes the form of a grid, indicating a time-scale across the top and a list of interventions at the side” (p 486). The development of pathways is well chronicled and it is easy to see why they have emerged to become so popular. Hospital administrators note that pathways meet changes required within the health care system, particularly relating to cost containment and efficient use of resources (Archer et al., 1997; Cardozo et al., 1998; Coffey et al., 1992; Pestian, Derkay, & Ritter, 1998; Wazeka, Valacer, Mary, Caplan, & DiMaio, 2001), while nursing and medical staff note they lead to positive outcomes for patients while maximising co-operation and collaboration between health care professionals (Dooley & White, 2003; Johnson, Blaisdell, Walker, & Eggleston, 2000; Kitchiner & Bundred, 1996; Welsh & Magnusson, 1999). It is important, however, to critically examine clinical pathways to determine their effectiveness and efficiency in delivering care and their usefulness in care planning. Any evaluation of clinical pathways involves examining whether the outcomes specified in the development of the clinical pathway are appropriate, and whether the clinical pathway achieves its’ designated function.
Quality health care requires critical examination of the processes used by members of the health team and the identification and discussion of successes or failures.

1.2 Significance of Bronchiolitis

Within the paediatric community, bronchiolitis is a significant problem as it is the most common lower respiratory tract infection in healthy infants under the age of one year (Bertrand, Aranibar, Castro, & Sanchez, 2001; Phelan, Olinsky, & Robertson, 1994), and results in hospitalisation in about 1% of cases (Kini, Robbins, Kirschbaum, Frisbee, & Kotagal, 2001).

The disease is extremely contagious, and infants living in crowded conditions are particularly at risk. In almost all cases, the disease follows a predictable course that lasts from seven to ten days after which the child recovers, without any long-term sequelae. In a small number of cases, however, long term respiratory disease may result; nevertheless, it should be noted that long term sequelae usually occurs with infants who already have some underlying lung or cardiac disease, due to prematurity or some congenital condition (Peter & Fazakerley, 2004; Phelan et al., 1994).

According to the Australian Institute of Health and Welfare [AIHW], there were 12 155 hospital admissions in Australia with bronchiolitis in 2003. Similarly, the latest United States National Hospital Discharge Survey completed in 2000 identified 285 000 hospital admissions per year with Acute Viral Bronchiolitis and Bronchitis (Kozak, Hall, & Owings, 2002). High admission numbers place considerable burden on the health care system and the limited resources available. As the disease is usually self-limiting and follows a reasonably predictable course, a clinical pathway appeared to be a suitable method for guiding the management of infants during their hospitalisation.
The potential benefits of using a planned approach such as a clinical pathway were further highlighted by data which suggested inconsistency in the management of this condition (Wang et al., 1996). That inconsistency was despite the publication of clinical guidelines developed by the Australasian Paediatric Respiratory Group (APRG) in 1993 and described by Barben, Robertson, & Robinson (2000).

1.3 Economic Cost of Bronchiolitis

According to Queensland Health data (QueenslandHealth, 2002), the average length of stay for all patients in public hospitals throughout Queensland remained unchanged for the period 1998/99 and 2000/01 (Uncomplicated 2.77 v 2.74 days, complicated 5.82 v 5.35 days); however, the average cost increased significantly (Uncomplicated $1807 v $2202, complicated $4301 v $4629). This source also stated that approximately 40% of those costs are directly related to nursing care. With over 2000 presentations just in Queensland Health hospitals each year, and with some suggestions that “admission rates have doubled during the last 10 – 15 years” (Vogel et al., 2003, p40), it is evident that bronchiolitis is a significant paediatric condition, and that any measure to reduce associated costs and promote efficiency in clinical management of the condition would be invaluable.

1.4 Background of the Current Study and links to the Wainwright Study

Due to increasing numbers of infants presenting with a diagnosis of bronchiolitis (270 cases at the Royal Children’s Hospital, Brisbane, in 1999), and lack of available data on how these cases were being managed, Wainwright et al. (2003) conducted a large double-blind randomised study that specifically examined the use of epinephrine in the treatment of infants with bronchiolitis. This study observed the effects, if any, of
epinephrine, on the severity of the illness of the infant with bronchiolitis and attempted to ascertain if use of this drug resulted in a reduced length of stay (LOS). Over 200 infants were involved in the study and a wide range of clinical and demographic data were collected. Results indicated that use of nebulised epinephrine in those infants who required supplemental oxygen and intravenous fluids was associated with extended lengths of stay when compared with infants in the placebo group. This is likely due to an increasing pulse rate that can increase the oxygen utilisation in susceptible infants. The Wainwright (2003) study identified oxygen saturation on admission, need for supplemental oxygen, and need for intravenous therapy as the major factors affecting LOS in hospital. The use of nebulised epinephrine had no significant effect on the length of stay in hospital for these infants, and appeared to have no significant clinical benefit.

The current study utilised participants from the Wainwright (2003) study as pathway data were collected on 194 infants on the Wainwright study, and another 35 infants who did not take part in the study but were eligible, who were managed on the clinical pathway. The two primary outcomes of the Wainwright study were the length of the hospital stay and the time until the infant was ready for discharge. The intervention of the epinephrine had no effect on outcomes and, in addition, there was no difference in outcomes between the patients who took part in the study and those that did not. Given that the drug therapy had no effect, the opportunity presented itself to examine the data on this cohort of infants to see if use of a clinical pathway had a positive impact on their clinical outcomes.

A clinical pathway was developed and used to promote consistency of nursing management during this prospective clinical trial. All infants admitted to the hospital
at the time of the Wainwright (2003) study were commenced on this bronchiolitis clinical pathway regardless of the arm of the study to which they were randomized. The initiation of the clinical pathway was seen as a way of establishing best practice by streamlining these infants’ care and by facilitating a consistent approach to identified clinical outcomes.

Three regional hospitals that participated in the Wainwright (2003) study also instituted a similar pathway that began when the infant was admitted to hospital with the diagnosis of bronchiolitis.

**1.5 Purpose of the Study**

The current study is an offshoot of the Wainwright (2003) study and attempts to examine the value of the clinical pathway and determine whether it led to improved outcomes in the management of infants with bronchiolitis. This study examines the characteristics and clinical management of a retrospective cohort of infants (control group) and the management of a prospective cohort of infants with bronchiolitis. The purpose of this study was to bridge the gap between research and practice by providing evidence to nursing, medical and allied health staff on the effectiveness of using a clinical pathway in their management of infants with bronchiolitis.

**1.6 Study Aims**

The specific aims of this study were to:

- determine whether use of this clinical pathway led to decreased LOS, time in oxygen (TIO), need for supplemental fluids, and need for readmission, for infants with bronchiolitis;
investigate whether use of this clinical pathway led to a change in the pattern of diagnostic testing by pathology and X-ray;

identify reasons for variances from the pathway;

investigate whether use of this clinical pathway led to a change in the drug prescribing practice for clinicians caring for infants with bronchiolitis;

identify the occurrence of baseline data relating to parental smoking status;

identify predictors for return to oxygen therapy for infants in the pathway group.

1.7 Hypothesis

Use of the selected clinical pathway leads to improved clinical outcomes, as measured by length of stay, length of time in oxygen, need for supplemental fluids, and need for re-admission, for infants with bronchiolitis.

1.8 Relevance of the current study

This study is designed to provide evidence regarding whether use of a clinical pathway led to better clinical outcomes for infants with bronchiolitis and to suggest reasons for variation in the use of this pathway. As one author comments: “although the promise of reduced costs and improved quality is enticing, the gaps in our knowledge about …pathways are extensive; therefore, like any new health care technology, pathway programs should be fully evaluated in order to understand the conditions under which that promise may be fulfilled” (Pearson, Goulart-Fisher, & Lee, 1995, p941). The findings of the study, therefore, will have implications for the nursing management of infants with bronchiolitis, both locally and internationally, by
providing data on the role of this particular clinical management tool in the care of infants with bronchiolitis.

1.9 Study Design

The study combines a prospective analysis of infants admitted to hospital with a diagnosis of bronchiolitis who were treated according to a pathway protocol with a retrospective analysis of historical control patients who were managed without the use of a pathway.

1.10 Study Sample

The study involves a randomly selected group of infants diagnosed with bronchiolitis who were admitted to the Royal Children’s Hospital, Brisbane, Gold Coast Hospital, Redcliffe Hospital, and Caboolture Hospital. The time frame for the historical control group was May 1998 to August 1999. Infants admitted during this period were not commenced on clinical pathways. During the period of May 2000 to August 2001, while the Wainwright (2003) study was in progress, all infants admitted to the four hospitals were managed on a clinical pathway; this group is examined in the prospective analysis of the clinical pathway.

The study was conducted in a variety of hospital settings which allowed larger numbers and also ensured that the study participants were likely to be representative of most infants hospitalised in either tertiary or regional hospitals. It also meant that infants with mild, moderate, and severe manifestations of the disease could all be included in the study.
1.11 Data collection

Data were collected from the clinical notes for the historical control group and from the clinical pathway records in the pathway group.

1.12 Structure of this thesis

Chapter 2 provides a review of the relevant literature. Specifically, it describes changes in nursing relating to patient care leading up to the introduction of clinical pathways. It defines and discusses clinical pathways, their advantages and disadvantages, and the reason they have developed. It also describes the variations between paediatric and adult settings. Chapter 2 looks at a description of clinical guidelines, how they differ from clinical pathways, and, finally, what variances are and why they were developed.

Chapter 3 addresses the processes of research. It describes the methodology and design of this study including the setting up of the clinical pathway and the instruments used to gather data. This chapter also looks at the process of data collection.

Chapter 4 describes the results of the data analysis, including the statistical tests used.

Chapter 5 discusses the findings of the study and presents implications for further research.

Chapter 6 concludes the study and identifies limitations that emerged as well as recommendations for the future.
CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

Clinical pathways have been described above in chapter one. However, more important than the mere definition of clinical pathways, is their evaluation in terms of their impact upon the nursing care of, and their influence on the clinical outcomes in infants with bronchiolitis.

Therefore, this chapter will briefly review the evolution and use of clinical pathways. Also, other models of care used recently within the nursing profession will be discussed for the purpose of comparison with clinical pathways and thus the effectiveness of clinical pathways will be established. Most importantly however, this chapter will analyse the arguments governing the selection and use of a clinical pathway in the current study.

2.2 Historical Development and Critique of Care Models in Nursing Practice

2.2.1 Introduction

It is commonly accepted that the role of the nurse has expanded and developed in response to a myriad of social and technological changes. Among other things, this has resulted in nurses caring for patients with increasingly complex conditions and having a stronger presence in the multi-disciplinary health care team (Cohen & Cesta, 1993; Lewis, Heitkempen, & Dirksen, 2004).

Since its inception, the nursing profession has continued to re-invented itself to meet new challenges, while maintaining a patient-centred focus (Binnie & Titchen, 1999).
Throughout this process, a range of models of care has been developed. Arguably, each has inherent advantages and disadvantages, because each was developed to suit the circumstances within the health care system at that time, but those circumstances inevitably change.

Early models of nursing care were task-orientated and functional, and remained so into the 1970s. During the 1980s, different models of nursing evolved, specifically team nursing and primary nursing. This led, in turn, to the development of case management as a model of care, particularly evident in the 1990s, and a model that incorporated the use of clinical pathways.

The current development in Australia today is the examination and implementation of Nurse Practitioners. While it is likely that the nurse practitioner role will impact further upon nursing practice, at the time of writing this paper, there was insufficient evidence to make valid conclusions (personal communication with Prof. Sandra Dunn).

### 2.2.2 Functional nursing

Functional nursing was task-oriented nursing which allowed hospitals and other health care facilities to use workers with various skill levels to provide patient care, with little focus on the quality of care delivered (Cherry & Jacob, 1999, p.328). The advantages of functional care models included; economic efficiency, time-efficiency and clear role delineations for nursing staff. While it is acknowledged that such advantages are significant, it is argued here that such approaches to nursing care are potentially unsatisfactory for all concerned. For nurses, such functional models provide little stimulation and few opportunities for decision-making. Cohen and Cesta (1993) support this argument and add that functional nursing patterns make no
provision for continuous holistic care nor do they accommodate individual patient needs (Cherry & Jacob, 1999; Cohen & Cesta, 1993).

**2.2.3 Team Nursing**

Team nursing emerged in response to the shortfalls of functional nursing. In this model of care, a senior nurse assumed overall responsibility for patient care while the more junior, inexperienced staff shared the responsibility of caring for a particular patient.

Clearly this was an improvement on the former care models because it increased the scope of clinical decision making and enhanced job satisfaction somewhat because such a model promoted in nurses a sense of ‘ownership’ in relation to their patients.

Undoubtedly, patients also benefited as they, not ‘essential’ tasks, became more of a focus of nursing care. Furthermore, hospital administrators identified this model as cost effective because non-professional responsibilities could be carried out by less qualified staff under the supervision of the registered nursing staff. It could also be argued that this approach to care meant each team member could contribute his or her particular expertise in the care of patients (Cherry & Jacob, 1999; Gullick, Shepherd, & Ronald, 2004).

Arguably, the major disadvantage of team nursing is the heavy reliance on the team leader, who had overarching responsibility for the team. Given the unpredictable nature of clinical practice, this over reliance on one key person had the potential to place staff and patients in untenable situations, especially in a health care system where the ideal of resources matching demands is not always realised.
2.2.4 The Nursing Process

This was an early attempt by the nursing profession to identify the framework within which it operated and to define its role within the health care environment. The formalising of the nursing process necessitated the development of nursing care plans so that a record of the team’s objectives could be clearly identified (Cohen & Cesta, 1993, p12). Nursing diagnoses enabled the nursing team to identify appropriate nursing interventions based on the unique needs of individual patients.

The obvious advantage of this method of care was that it promoted autonomous decision making within the nursing profession. While it has been long argued that autonomy is a fundamental characteristic of professional practice, it is further argued here that nurses need to exercise autonomy in conjunction with other health care professionals. Conversely however, the nursing process neglected this aspect of professional collegiality.

As a method of care, the nursing process did not include other health professionals on the care team which meant that nursing staff were often working in isolation. As a result, non-nursing staff made patient decisions that frequently were not shared with the nursing team. Similarly, nursing decisions were frequently not communicated to allied health professionals caring for the same patients. It is argued here that, as would be expected with any method of care in which there is such little interdisciplinary collaboration, the nursing process was fundamentally flawed.

Not surprisingly the nursing profession sought a model of care that incorporated the significant input of other health professionals, while enabling nurses to accurately assess and plan individualised care of their patients.
2.2.5 Primary Nursing

Primary nursing as a significant evolution from previous models was a major step towards addressing the need for a multidisciplinary team. As such, it became the standard of health care delivery in the early 1970’s and 1980’s (Cherry & Jacob, 1999).

In this model, an individual nurse assumed responsibility for the care of the patient, which facilitated a formalised collaboration and cooperation with other health professionals. Hence, proponents of primary nursing (Lyon, 1993; Yoder-Wise, 1995) argued that it allowed the nurse to take on a truly professional role. This, of course, raises the question of ‘what is meant by “truly professional”?’ however this long and unwieldy discussion is not presented here as it would add little to the main subject under discussion. Undoubtedly, however, primary nursing did much to promote autonomous decision-making based on rigorous patient assessment which in turn resulted in the implementation and evaluation of planned, rational nursing care (Cherry & Jacob, 1999; Cohen & Cesta, 1993; Gullick et al., 2004; Lyon, 1993).

From the above analysis, it can be seen that primary nursing requires an enormous commitment to continuity of care and the establishment of a close relationship with the patient. While many would argue that this is an ideal in nursing care, it could also be rigorously argued that such an approach is dependent on a stable staff establishment of highly skilled and highly motivated nurses and that, in many cases, there are insufficient numbers of suitably experienced nursing staff within the health care environment, a problem which is further complicated by workforce retention issues.
2.2.6 Case Management

With the introduction of a case management approach, some of the problems of primary nursing were resolved. Rather than nurses having a separate team, they became legitimate members of the multidisciplinary health team which meant that care was much more coordinated, efficient and less draining on the available expertise of nurses.

At the same time case management was introduced (in the 1990’s) so too was the notion of economic rationalisation and funding based on diagnosis-related groups (DRG), which meant that a set amount was provided for a particular patient diagnosis, regardless of the actual cost involved in the care of the patient. In short, nurses, other health professionals, and hospital administrators were forced to become more outcomes focused. As a model that appeared to cut costs while maintaining quality, case management was readily endorsed by health professionals and health agencies (Etheridge, 1989). Various authors (Blegen, Reiter, Goode, & Murphy, 1995; Cherry & Jacob, 1999; Cohen & Cesta, 1993; Wadas, 1993) have also argued vigorously in favour of this model, citing factors including increased accountability, increased collaboration; improved job satisfaction and professional development opportunities. Falconer et al. (1993) further argued that the escalating pressure to contain cost and to improve quality advanced a “call for health practitioners to re-examine the central dimensions of practice” (p8). While this appears to be a reasonably logical response, no substantial evidence could be found to support this argument. Whereas, Blegen et al. (1995) present a much more convincing proposition with their argument that, ultimately, reduced use of resources will lead to reduced quality in care.
Case management did however, provide regimen of anticipated or ‘usual’ clinical outcomes for the patient, and a way of easily and quickly identifying any variances. Necessary physical and human resources could be identified and anticipated, which allowed for better planning and cost efficiency (Blegen et al., 1995). In order to promote consistency and efficiency in the management of their case load, many nurses adopted clinical pathways which provide a predetermined plan of care for patients with specific clinical conditions.

2.3 Evolution of Clinical Pathways

Clinical pathways appear to fulfil two desirable criteria, that is, they accommodate both forward planning and cost efficiency. Arnold and Boggs (2003), support this contention and claim that clinical pathways also improve quality, encourage interdisciplinary communication and focus on patient outcomes.

2.4 Advantages of Clinical Pathways

Given the above discussion, it would be tempting to assert that, as a model of care, clinical pathways are the definitive model for nursing practice. The entertainment of such a proposition warrants a much more in depth examination of clinical pathways.

Indeed, many authors have identified the advantages of pathways (Archer et al., 1997; Bailey, Weingarten, Lewis, & Mohsenifar, 1998; Cardozo et al., 1998; Chin et al., 2002; Coffey et al., 1992; Dooley & White, 2003; Goldberg, Chan, Haley, Harmata-Booth, & Bass, 1998; Johnson et al., 2000; Kitchiner & Bundred, 1996; Pestian et al., 1998; Phillips & Crain, 1998; Wazeka et al., 2001; Welsh & Magnusson, 1999), and these will be considered in further detail below.
2.4.1 Decreased length of hospital stay

According to Lagoe and Aspling (1997) reduced length of stay [LOS] is associated with the use of clinical pathways. Decreased length of stay is perhaps the most significant advantage of clinical pathways as this in itself is a self-evident positive outcome for both the patient and the health care agency. Reduced length of stay also has other advantages for infants such as reducing the risk of iatrogenic infections and social burden on families. Similarly the link between reduced LOS and reduced cost of hospitalisation hardly needs to be pointed out and is discussed in more detail below. Nonetheless, Lau et al. (1996), in an examination of variances within an Australian health care setting, also place emphasis on reduced length of stay, claiming that it is a useful indicator of the efficacy of the clinical pathway being used.

2.4.2 Cost containment

Cost containment continues to be a crucial issue for all health care organizations to the extent that it has become embedded in health care policy (Blegen et al., 1995). Therefore, Greenwood’s (1996) sustainable claim that, departure from the critical pathway increases the cost of patient care, is an influential factor in the adoption of pathways as a model of care. It could be further argued that organisations primarily implement clinical pathways as a cost managing method.

2.4.3 Consistency and coordination of care

Earlier task-focussed models were rightly criticized for producing fragmented patient care (Cohen & Cesta, 1993). With the introduction of clinical pathways, consistency in patient care has been a notable outcome. This is because in the planning phase of the pathway, the coordination of activities is pre-determined so that each member of the health care team knows the role they have to play to achieve mutually identified
goals. Numerous authors confirm this view (Archer et al., 1997; Dooley & White, 2003; Smith & Gow, 1999). According to Colucciello & Mangles (1997) not only are clinical pathways an essential step forward in resource and time efficiency, they provide improved collaboration and coordination of care.

2.4.4 Team building

According to de Luc (2000), team building is one of the major successes achievable through clinical pathways. While on the surface, this may not appear to be a major advantage, it can be competently argued that any improvement in team relations, results in a more seamless and satisfactory realisation of mutual goals. Any arguments to the contrary would be difficult to sustain.

2.4.5 Measurability

In reviewing the advantages, Smith and Gow (1999) contribute a unique angle to the argument in claiming that a major benefit of pathways is that they provide a means of measuring care delivered, thus directly linking care to quality. These authors also point out that pathways necessarily minimise practice variation and this was one key factor behind the decision to use clinical pathways as a management tool for this study.

2.5 Disadvantages of Clinical Pathways

Despite their many benefits, clinical pathways are not without disadvantages, which has been noted by a number of health care professionals, including many nurses, who felt that clinical pathways needed to be used with caution (de Luc, 2000; Kwan-Gett, Lozano, Mullin, & Marcuse, 1997; Lau et al., 1996; Pearson et al., 1995; Perez, 1996;
Scott, 1995). Specific factors that might jeopardise the success of clinical pathways were raised in the literature and are discussed below.

### 2.5.1 Time-consuming

Clinical Pathways have been described as time-consuming by various authors (Abbott, 1993; de Luc, 2000). These authors suggested that the time taken to develop and implement them may be putting unnecessary pressure on staff that already has significant work loads. Health care professionals may have been unable or unwilling to commit the time required to make clinical pathways a success.

### 2.5.2 Limits problem solving

Because the essence of clinical pathways is to have a planned model of care for the patient with a specific condition, it can be argued that this is the antithesis of reasoned decision-making by the health professional. It may be that if staff are given no opportunity to problem solve or are not experienced enough to effectively make decisions because of the availability and accessibility of clinical pathways, then mistakes or omissions may occur. Staff may blindly follow the developed pathway without recognizing that the particular requirements for their patient lie outside the identified parameters. If guidelines for care are already established then the role of health care systems to educate inexperienced staff to use initiative and problem-solving skills may be seriously compromised. Too prescriptive a pathway may lead to blind following of a regime. At this point, the individuality of the patient and the staff member is lost. One paper, looking particularly at the Australian context, stated “aspects of care which fall outside the parameters of the framework or which require cognitive effort to relate particular situational cues to such parameters may well be
missed by the attending nurse…it seems at the moment that critical pathways virtually
determine care planning rather than simply guide it” (Gray & Pratt, 1995, p318).

2.5.3 Lack of individualised care

Critics of clinical pathways maintained that there was lack of individualised care for
both patient and staff when patient care was mapped out on a clinical pathway. It was
seen as insensitive to individual requirements and “dehumanising” for the patient
(Georges & McGuire, 2004; Greenwood, 1996; Ireson, 1997).

2.6 Evaluation of clinical pathways in current use

For more than ten years, the use of clinical pathways to assist in the planning of
patient care has been explored, particularly in the management of a range of adult
conditions. Many authors have reviewed these pathways, finding them very effective
in a wide variety of circumstances (Bailey et al., 1998; Cardozo et al., 1998; Phillips &
Crain, 1998; Pritts et al., 1999). Some authors have attempted to define particular
groups of patients who would specifically benefit from the use of pathways (Lagoe &
Aspling, 1997). The task of evaluation of the clinical pathway as a management tool,
aligned with current literature in which other authors suggested that there was a need
to stop and look at what was happening in relation to the development of clinical
pathways (Cardozo et al., 1998; Kelly et al., 2000; Miller, Sater, & Mazur, 1996;
Wazeka et al., 2001). They urged health care professionals to validate and justify the
theoretical basis underpinning the clinical pathways in use, and to evaluate their
efficiency (Chou & Boldy, 1999; Forrest, Shipman, Dougherty, & Miller, 2003;
Godlee, 1998; Kwan-Gett et al., 1997; Wadas, 1993). Clearly, we were left in no
doubt that evaluation of clinical pathways was crucial. In particular, it was evident
that this should be done with a range of clinical conditions to determine if the
pathway was an efficacious management tool. Any such evaluation should include not just the tool’s effectiveness in clinical outcomes but also, how well staff uses this particular management tool. The clinical pathway had been chosen as a management tool by the hospital because it appeared to promise a number of advantages such as consistency of clinical management and improved clinical outcomes in terms of length of stay and need for readmission. These advantages were assumed – they needed to be validated or refuted. This study has attempted to do this by looking critically at whether the clinical pathway used led to improved outcomes for infants with bronchiolitis.

2.7 Paediatric Clinical Pathways

The advantages and disadvantages of clinical pathways just described had been considered by many health professionals in a wide variety of circumstances. In many instances, clinicians and managers had considered that the advantages clearly outweighed the disadvantages, particularly in relation to clinical pathways used in the adult setting (Bailey et al., 1998; Cardozo et al., 1998; Phillips & Crain, 1998; Pritts et al., 1999). As a result of these favourable reviews, clinical pathways came to play a major role in adult health settings; however, little research into their efficacy in children’s setting has been conducted.

One likely reason is that it is difficult to obtain paediatric study cohorts of sufficient size to render valid results. Perez (1996) commented on this very point, stating “inherent to the practice of pediatrics (sic) is the issue of small sample sizes. With few exceptions, it is difficult for any one hospital to generate enough data about the care delivered and outcomes achieved on any pathway within a short period of time. Additionally, the unique problems that exist for the paediatric patient means that
clinical pathways developed for adults often cannot be successfully adapted for the paediatric environment” (p78).

There are limited studies that have been done, however, where pathways have been developed and used to manage paediatric patient care (Chin et al., 2002; Johnson et al., 2000; Kelly (Jr) et al., 2000; Pestian et al., 1998; Wazeka et al., 2001). Critical analysis of the use of these pathways in infants has revealed small study group numbers, and there appear to be few published studies available that specifically evaluate the use of clinical pathways in the management of bronchiolitis. A recent study published by Wilson, Dahl & Wells (2002) only explored the reduction in the use of antibiotics for infants with bronchiolitis by using a clinical pathway, without considering the wider issue of whether the clinical pathway itself actually contributed to improving the outcomes for these infants. Peter and Fazakerley (2004) conducted an audit of a bronchiolitis clinical pathway that had been introduced at one hospital but were unable to identify any improvements that the pathway had made “in the mainstays of care for bronchiolitis” (p35). They also did not give any specific recommendations that clinicians could use when caring for infants with bronchiolitis. As Anders et al. (1997) indicated “the literature is relatively silent regarding studies that have scientifically validated the use of these paths” (p45).

2.8 Clinical Guidelines v Clinical Pathways

At the same time as the development of clinical pathways was the development of clinical guidelines, which have been defined as “systematically developed statements to assist practitioner decisions about appropriate health care for specific clinical circumstances” (Grimshaw & Russell, 1993, p1317). In the United States they became very popular and many were produced commercially for standardised use throughout
the country. Limited studies have been conducted into the use of clinical guidelines, particularly relating to bronchiolitis though these studies have generally been positive finding that clinical guidelines were helpful in reducing excessive drug therapy and diagnostic procedures (Adcock, Sanders, & Marshall, 1998; Kini et al., 2001; Muething et al., 2004; Perlstein et al., 1999).

The discussion thus far, has lead us to consider the argument that clinical pathways are not very different from a set of clinical guidelines. The difference between them appears to be the amount of detail provided for the end user. While clinical guidelines provided an outline of requirements for a particular clinical condition, pathways were much more detailed and outcomes focussed. In addition, as one author contends, “a key feature of pathways is their adaptability and flexibility to suit local requirements” (de Luc, 2000, p486). Perlstein et al. (1999), in their evaluation of clinical guidelines for bronchiolitis, give this distinction: “unlike the evidence-based recommendations for best practice in guidelines, clinical pathways are frequently more focused on enhancing efficiencies and explicitly list daily expectations for care elements that may or may not be supportable using existing evidence” (p1336). If this is, in fact, true, then this study seeks to address this shortfall by providing an evidence base relating to the care of infants with bronchiolitis. Of interest is one specific element of the guidelines that Perlstein et al. endorse, namely the lack of necessity to explain or document any variances from intended practice. It is difficult to see how the guidelines could be enhanced or improved if there was no documentation relating to variances.
2.9 variances from the clinical pathway

An integral part of the clinical pathway is the documentation of variances. De Luc (2000) describes them in this way:

> Any deviation from the plan (of care) is documented as a ‘variance’, the analysis of which provides information for the review and monitoring of current practice. The term ‘variance’ in the pathway context should not be confused with its statistical meaning. In the pathway context, variance analysis is the in-built system for recording unexpected events which occur during patient care – events which are different from those predicted in the pathway (p486).

Arnold and Boggs (2003) see a variance more in terms of a warning signal for nursing staff: “A variance or exception occurs when a client does not progress as anticipated or an expected outcome does not occur. A variance is a red flag, alerting staff of a need for further action to assist the client” (p590). Other authors (Beyea, 1996; Lau et al., 1996) see the tracking of variances as a quality assurance tool. In order to track variances, however, nurses need to have a clear framework within which they work which establishes the usual, consistent outcomes for the patient for whom the clinical pathway was developed. In conjunction with the documentation of variances, however, is the notion of the individuality of each patient which must always be recognised and maintained (Ireson, 1997). This point needs to be emphasised so that variations in responses between different patients are not necessarily variances that need to be documented and actioned.

Variances are commonly categorised into three different groups. The first is a system variance which “involves a situation in which the institution or community is unable to provide the appropriate level of care or specific intervention” (Beyea, 1996, p10). This type of variance could be, among others, the unavailability of technical staff to carry out a particular test or examination. For example, the pathology testing cannot
be done at a certain hospital because it does not have the resources to carry out that
test. Similarly, if a decision is made to discharge a child late in the afternoon, there
may be no pharmacist available at that time to dispense discharge medications, or no
social worker on duty who can organise required transport or home help. All of these
examples represent reasons why a child would not be sent home from hospital
although they were, from a clinical point of view, ready for discharge. These can lead
to variances from the pathway which has pre-determined the length of stay. The
obvious flow-on effect that these variances have is on health care costs because
human and material resources are being used after they are no longer required.

The second type is a health care provider variance. In this situation, some action or
inaction on the part of a member of the health care team results in the patient not
progressing along the pathway as expected. It may be that the medical officer does not
review an infant who has been weaned off oxygen to see if he or she is ready for
discharge. Other examples include medication given incorrectly or omitted altogether,
or missed treatment such as a physiotherapy session. If this variance had a deleterious
effect on the patient, then it could alter their expected outcome.

By far the most common type of variance, however, relates to the patient. They do
not progress along the pathway as expected, and, in some cases, an unmet need will
be identified by the care givers, usually the nurse responsible for the patient’s care.
For example, the infant may be unsettled due to separation from a parent or because
he or she is in an unfamiliar environment. Another variance relating to the patient
may be if they develop an infection which extends their hospital stay and requires
them to have antibiotics or analgesia.
Variances may also be expressed in positive terms, e.g. if the patient progressed ahead of the expected time frame or achieved better than anticipated outcomes. The obvious result then is earlier than expected discharge.

The recording of variances is important, then, both in terms of the patient’s ongoing management and for evaluation of the effectiveness of a pathway. For this reason all variances in this study were examined to determine their effect on patient outcomes.

2.10 Conclusion

In this chapter both the advantages and the disadvantages of clinical pathways have been described within the context of evolving models of health care. Evidence from various authors suggested that clinical pathways were an effective management tool, both in adult and paediatric settings, particularly with their emphasis on the identification of variances. Because of this emphasis, and because clinical pathways were seen as more directive, it was suggested that they differed from clinical guidelines and so were possibly more effective as a management tool for infants with bronchiolitis. Just how effective, will be determined in the following chapters.
CHAPTER 3: METHODOLOGY

3.1 Introduction

This chapter will discuss the design and implementation of the study. In studies that look at the influences which impact upon health outcomes, it is appropriate to use quantitative methods. Accordingly, this study, which combines a retrospective historical control group and a prospective intervention group, consists of the collection and analysis of quantitative data.

3.2 Development of a bronchiolitis clinical pathway

Clinical pathways for bronchiolitis have been developed at various hospitals and commence on the infant’s arrival in the Emergency Department and continue until the time of discharge. These clinical pathways describe the usual or expected pattern of care for an infant with bronchiolitis, and touch on the more unusual patterns that may sometimes occur.

An initial nursing respiratory assessment is completed and factors such as oxygen saturation while breathing room air, respiratory rate and effort, heart rate, temperature, and skin colour and tone are noted. Presence or absence of wheezing or crackles on chest auscultation and level of hydration are also recorded.

The need for oxygen therapy and supplemental fluids is determined based on how an infant appears at this initial assessment. Factors leading to a need for these therapies can include low oximetry on room air, signs of dehydration, or unsatisfactory feeding. A medical and social history of the infant is also obtained according to clearly specified guidelines. This history includes aspects such as:
The development of the bronchiolitis clinical pathway was based on studies of pathways used to manage the care of children with other respiratory conditions, notably asthma, as this disease is responsible for the majority of childhood respiratory admissions (QueenslandHealth, 2002; Wazeka et al., 2001; Welsh & Magnusson, 1999).

3.3 The Royal Children’s Hospital, Brisbane, Clinical Pathway

The bronchiolitis clinical pathway used in this study was developed at the Royal Children’s Hospital, Brisbane in 2000 in response to increasing numbers of children presenting (270 cases in the year prior to introduction), and the lack of data available about the way in which these cases were being managed. Reports from other authors, anecdotal evidence, and results of a staff survey conducted in all clinical areas across a range of health care professionals (Appendix 1) also served to identify apparent indiscriminate variations in care being given. These variations were attributed to the use of unproven or non-efficacious methods and therapies (Kellner, Ohlsson, Gadomski, & Wang, 2001; Perlstein et al., 1999; Wang et al., 1996).
Data available from other centres in Australia, particularly the Royal Children’s Hospital in Melbourne and the Women’s and Children’s Hospital in Adelaide, and review of medical literature at the time appeared to demonstrate widespread and inappropriate use of salbutamol and steroids (Barben et al., 2000). A review of the care standards for treatment of infants with bronchiolitis had not been undertaken in Brisbane, and there were no current guidelines in place for the administration of, or weaning from, oxygen in infants with bronchiolitis.

A multidisciplinary team was set up at the Royal Children’s Hospital, Brisbane, for the purpose of changing the way in which bronchiolitis was being managed. The formation of this team was in line with the call from Grimshaw and others who wanted to promote the incorporation of research findings into clinical practice (Grimshaw, Eccles, & Russell, 1995). Bero et al. (1998) refer to a team such as was set up at the Royal Children’s Hospital as “local consensus processes (which is the) inclusion of participating practitioners in discussions to ensure that they agree that the chosen clinical problem is important and the approach to managing the problem is appropriate” (p467).

Etheridge (1989) described the process for managed care that was implemented in this research study on bronchiolitis. According to Etheridge, there are four steps to initiating managed care:

Step 1 The first step is to specify target case types. . . . case types are diagnostic populations . . . that require similar care, use similar amounts and kinds of resources, and have approximately the same length of stay

Step 2 The next step is to identify the nurses and physicians who are most familiar with the target case types. Once the physician-nurse teams have been identified, they outline the time frames within which care will proceed . . .
Step 3 The third step is to identify expected outcomes of care for each problem . . . Movement towards the outcome is identified by stating intermediate goals. . .

Step 4 The team next identifies the nursing and physician processes or activities that are necessary to move the patient toward the outcomes and intermediate goals . . . The processes and intermediate goals are also identified by time periods. Identifying the time periods facilitates a review of the sequence of critical events, such as test and procedures, to make sure that they are scheduled in an effective, efficient manner (p5-6).

Recognising the value in a team approach, the multi-disciplinary team consisted of staff from nursing, medicine and allied health. Different areas of the hospital were represented with particular interest from staff in the Department of Emergency Medicine and the Babies Ward. The team also consisted of relevant staff from the regional hospitals at the Gold Coast, Redcliffe and Caboolture. Formal goals from this team were identified:

- To standardise a multi-disciplinary plan of care and treatment for infants with bronchiolitis;
- To ensure improvements in the plan of care for bronchiolitis;
- To improve patient outcomes;
- To decrease the length of stay for infants and their families.

Specific patient outcomes were then identified:

- The family will receive evidence based quality care, from a multi-disciplinary team, using a clinical pathway that encompasses a continually improved high standard of care.
- There will be a reduced length of stay for patients and their families.
- The family will receive consistent communication from the team and have a good understanding of the plan of care and the expected outcomes of that care.
- The family will be given the criteria expected for discharge from hospital.
Community members of the health care team will have a greater understanding of the care provided.

After formalising the goals and outcomes, a briefing note was prepared and submitted to the hospital Management Committee for endorsement.

The outcome of this consensus group was the development of the bronchiolitis clinical pathway. The pathway was developed only after a review of clinical pathways currently in use in other Australian paediatric hospitals. The initiation of the clinical pathway was seen as a way of establishing best practice by streamlining the care of these infants, and by facilitating a consistent approach to the identified clinical outcomes.

In discussions between members of the clinical pathway group, it became evident that there was quite a variation in management practice between each of the institutions and even within the same institution, and so it became important for all participants to describe their common practices and explain reasons for the use of these practices. For example, nasogastric feeding was much more common in regional hospitals whereas intravenous fluids were more common in the tertiary centre because of the availability of medical staff to insert the intravenous line. In regional centres, however, nursing staff were available to insert a nasogastric tube to feed the infant. At this time, there was limited reference in the literature as to which was the most appropriate method of feeding. Phelan et al. (1994) had stated: “If the baby is unable to feed satisfactorily orally, fluid should be given either intravenously or by intragastric tube but preferably the former route in sick infants” (p76). The consensus view of the Australian and New Zealand paediatric respiratory physicians published in 1993 also mentioned fluid therapy stating that “Nasogastric tube feeds are reserved for the recovery phase because of increased risk of aspiration during the acute phase
(Dawson et al., 1993, p336)”. The outcome of discussions was that intravenous fluids were to be the preferred method of administration of supplemental fluids across all sites, but that they were not to be given unless the infant had respirations above 60 per minute and required oxygen, was feeding poorly or not at all, and was lethargic. The fluids could be reduced when the requirement for oxygen decreased, feeding was happening without the infant becoming distressed, and some oral feeds were being tolerated. Finally, the intravenous fluids could be ceased if the patient was stable for six hours, was tolerating good feeds, and had been reviewed by a medical officer.

There was even less guidance from the literature when it came to the use of supplemental oxygen. The paediatric respiratory group had stated that “When using nasal prongs the maximum flow utilized is 2 L/min, and caution needs to be exercised above 1.5L/min”. They had made no reference, however, to when these levels of oxygen should be applied specifying only that an oximetry reading of 95% meant the need for “probable hospital management (Dawson et al., 1993)”. Another study had emphasised that “Arterial oxygen saturation (SaO₂) is the most relevant outcome measurement of the adequacy of ventilation and ventilation-perfusion balance” (Ho, Collis, Landau, & Le Souef, 1991, p1061). The clinical pathway group were aware that monitoring of oxygen saturation was important and that oxygen had to be carefully administered, but there were no specific literature stating what level of oxygen saturations was significant and how much oxygen needed to be administered. Once again, the consensus opinion of the group was determined, so that all staff involved in the pathway could work comfortably with the decisions made in relation to the use of supplemental oxygen. In the end, a saturation level of 94% was used as a cut off point. Less than that level and oxygen was to be administered. Other criteria used to determine if oxygen was needed related to whether the infant became
distressed during feeding or whether there was a sign of an altered level of consciousness, such as lethargy or irritability. If present, oxygen was to be administered. When the infant was stable in the same level of oxygen for four hours and had saturations >93%, was feeding without distress, and was hydrated, then oxygen was weaned at a rate of 0.25L/min every four hours. This guide was used for most of the infants who only required nasal prongs. For the sicker infants requiring a mask or a headbox, similar specific criteria were detailed so that the procedure for administration and weaning of oxygen were consistent at every site.

Physiotherapy was not used for these infants because of recommendations from current literature advising that chest physiotherapy was of no benefit in the clinical management of acute viral bronchiolitis in the absence of other pathologies (Nicholas, Dhouieb, Marshall, Edmunds, & Grant, 1999; Perlstein et al., 1999). Indeed, as the paediatric respiratory group suggested, “physiotherapy …may induce falls in oxygen saturation (Dawson et al., 1993, p336)”.

Documentation relating to the use of drugs made decision-making by the clinical pathway group easier. A significant number of authors (Cade et al., 2000; Dawson et al., 1993; Klassen et al., 1997; Perlstein et al., 1999; Roosevelt, Sheehan, Grupp-Phelan, Tanz, & Listernick, 1996) stated that there was no clinical evidence that the use of steroids was of value in the management of infants with bronchiolitis. Based on these findings, and their own professional judgment, the clinical pathway group were in agreement that steroids were not to be used for infants with bronchiolitis, and that if these drugs were ordered for a particular reason, then this order was to be documented as a variance on the pathway.
The pathway which was developed to this point, therefore, had outlined admission and in-patient requirements, and allowed for the reporting of any variances that occurred. Discharge was suggested when respiratory status had been stable in room air for 10 hours, there was nil or mild chest recession, oxygen saturation in room air was > 93%, the child was feeding well, and discharge plan for parents and letter for the LMO were completed. Once again, there was no published literature on when it was “acceptable” to discharge these infants, and so it was a consensus of the clinical pathway group which prevailed. Individual staff experiences and clinical judgment gained over time were used to arrive at the specified discharge criteria that staff across all of the sites felt were safe practice. Observation sheets were then developed which were to be used to facilitate data collection on chest recession, tracheal tug, respiratory and heart rates, blood pressure, oxygen saturations, and the use of supplemental oxygen.

The clinical pathway had now been developed and received approval to be trialled and, finally, introduced throughout the hospital. Prior to this implementation, however, education sessions were conducted for all clinical staff to promote support for the pathway by providing information on why infants with bronchiolitis were going to be managed on a clinical pathway.

To date, staff had received only limited exposure to the use of clinical pathways for other paediatric conditions. There were no clinical pathways in use in the Royal Children’s Hospital, so quite extensive and frequent education sessions had to be carried out. These sessions were carried out both on a formal level with PowerPoint lectures in a classroom setting, and on an informal level in the clinical area. In this situation, staff were released from the clinical area for short periods of times and
encouraged to ask questions in a small group setting. Often this small setting meant that individual queries and concerns could be sorted out easily and information could be fed back to the staff within that specific area. In addition, resource folders were left in all clinical areas, especially in Babies Ward and the Department of Emergency Medicine. The decision to use a variety of educational approaches aligned with recommendations from Barben et al. (2000), who suggested that “having developed local guidelines, implementation must include interactive educational sessions with all relevant practitioners” (p495). Grimshaw et al. (1995) had also determined that “valid guidelines, when appropriately disseminated and implemented, can lead to changes in clinical practice and improvements in patient outcome” (p37). Bero et al. (1998) described a “consistently effective intervention (to promote behavioural change among health professionals)” as “interactive educational meetings (participation of healthcare providers in workshops that include discussion or practice)” (p467) - exactly the type of sessions the clinical pathway group were conducting.

In particular, the fact that there was a guide for the administration of oxygen and intravenous fluids in the pathway, was highlighted for staff. They learned the indications for using supplemental oxygen included oxygen saturation less than 94 percent or any combination of: significant respiratory distress, a respiratory rate above 60 per minute, or difficulty in feeding. Staff were advised specifically that oxygen was ceased where oxygen saturations were consistently above 93 percent or when the infant had been stable for four hours and was starting to tolerate oral feeds. The guideline that infants should receive intravenous fluids, rather than oral feeds, if there was an oxygen requirement and respiratory rate above 60 per minute, or if oral feeding was inadequate, was emphasised as this guideline was a change to current
practice for some staff members. Staff learned that comfort feeds were allowed, and that intravenous fluids were ceased when the infant could tolerate oral feeds.

The clinical pathway was introduced only after these extensive education sessions were completed. The introduction was hospital wide for all infants admitted with the diagnosis of bronchiolitis. Education sessions were continued following its introduction in order to accommodate any new staff and to address any ongoing queries. These sessions served to reassure any staff who may have encountered problems or had identified areas of concern. A recurring query included the nature of variances and how these variances should be documented.

Three other hospitals, all regional, also introduced the same clinical pathway for management of infants with bronchiolitis. These were the Gold Coast Hospital, Redcliffe Hospital, and Caboolture Hospital. These institutions underwent the same process of both formal and informal education sessions on the purpose and conduct of a clinical pathway for bronchiolitis. Once again, these sessions took place prior to use of the pathway in the clinical area. These hospitals only had one paediatric ward and a limited number of staff involved. This skill mix differed from the staff at the Royal Children’s Hospital, many of whom were relatively inexperienced. The introduction of the clinical pathway was both easier and quicker in the regional hospitals because of these factors.

3.4 Study Design

This study was designed to examine whether the use of clinical pathways for the management of infants with bronchiolitis led to an improvement in their clinical outcomes.
The study combined a prospective analysis of 229 infants admitted to hospital with a diagnosis of bronchiolitis treated according to a pathway protocol (pathway group) with a retrospective analysis of 207 historical control patients with bronchiolitis managed without a pathway.

### 3.5 Population

For the historical control group, data were collected on a random group of infants with a clinical diagnosis of bronchiolitis as determined by the admitting physician in the Department of Emergency Medicine. The infants were admitted to the Royal Children’s Hospital, Gold Coast Hospital, Redcliffe Hospital, and Caboolture Hospital. Infants in this retrospective analysis were randomly selected from a computer-generated list of all admissions to the participating hospital during the timeframe of May 1998 to August 1999. Infants admitted during this period were not started on clinical pathways.

During the period of May 2000 to August 2001, all infants admitted to the four participating hospitals were managed on a clinical pathway. The management of all bronchiolitis admissions on a clinical pathway was introduced as part of a prospective double-blind multi-centre randomised controlled study that examined the role of nebulised epinephrine in the management of infants with bronchiolitis. This was the Wainwright study (Wainwright et al., 2003). There were 194 infants who took part in the Wainwright study and during this study the infants were randomised to either the epinephrine or the placebo arm. Another 35 infants who were admitted during this period did not take part in the Wainwright study, but were eligible for inclusion, and were also managed on a clinical pathway. No significant differences in outcomes were found between the infants in either the intervention or comparison group.
Because there were no significant differences in outcomes for infants in the intervention or comparison groups, an analysis of prospective clinical pathway data of the whole sample, including the 35 non-participating infants, was undertaken.

3.6 Inclusion Criteria

Infants for whom the following criteria applied were included in the study:

- All infants aged up to 12 months (or 12 months corrected age if premature) admitted with a clinical diagnosis of bronchiolitis
- Infants born prematurely with chronic neonatal lung disease
- Infants where the record indicated that this was the infant’s first wheezing episode requiring admission to hospital.
- Infants for whom informed consent by parents or guardians could be obtained.

This was the same inclusion criteria that were used in the Wainwright (2003) study.

3.7 Exclusion Criteria

Infants for whom the following criteria applied were excluded from the study:

- Infants with cardiac disease or other significant respiratory problems such as cystic fibrosis
- Infants with medical records indicating the use of corticosteroids (oral, IV or nebulised) within 24 hours of presentation, or use of bronchodilators within four hours of presentation to the hospital.

This was the same exclusion criteria that were used in the Wainwright (2003) study.

The same inclusion and exclusion criteria as the Wainwright study were selected so that the population of the historical control group was as similar as possible to the pathway group.
3.8 Sample Size

Bach and Sharpe (1989) discuss the issue of sample size, stating that “a key question which needs to be asked in designing such a study (i.e. the comparison of two groups) is how many subjects are necessary to have a reasonably good chance of verifying a difference which actually exists” (p64). For the purposes of this current study, it was calculated that based on a mean length of stay of 82 hours and standard deviation of 67 hours (data obtained from the Wainwright study), a sample size of 200 subjects in each group (i.e. intervention and comparison group) was calculated as required to detect a difference of 12 hours (a clinically relevant difference) between groups with a power of 80% and an $\alpha = 5\%$. The Wainwright study provided the means of calculating the power analysis for this current study although Wainwright et. al (2003) had already noted that, for their study, “calculation of power was difficult, because no accurate data were available for their (intervention) group of patients on the standard deviation of the length of the hospital stay or the length of time receiving supplemental oxygen”(p30).

3.9 Statistical Analysis

The infants in the historical control group and the infants managed using a clinical pathway were compared with respect to demographic data, baseline clinical measures, and study outcomes. Comparisons between different hospitals as well as between the two groups were made to determine if there was any inter-hospital variation in practice. The Chi-square test for significance was used to determine any statistically significant differences between the two sets of discrete data and a one way ANOVA test was used for the continuous data. A $P$ value $< 0.05$ was considered statistically significant. Logistic regression was used to screen risk factors for return to oxygen.
3.10 Patient Safeguards

For this study, parental/guardian consent was obtained for all patients on the pathway who participated in the Wainwright (2003) study. Other infants who were admitted to the hospitals following the introduction of clinical pathways were automatically managed according to the pre-determined pathway protocol. Data on the infants who did not participate in the Wainwright study was collected from the clinical pathway documentation in the clinical file and only patient record numbers were used. Data on all the historical control infants was also gathered using only patient record numbers in order to protect confidentiality. Approvals from each of the four hospital Ethics Committees were obtained for the collection of this clinical data. All records relating to the research were maintained securely for the duration of the study with the study investigator. Only group data was described in study findings, with no identifying information reported.

3.11 Participating centres

- Royal Children’s Hospital, Brisbane
- Gold Coast Hospital
- Redcliffe Hospital
- Caboolture Hospital

3.12 Instruments

A Clinical Pathway document that collected demographic, social, and clinical data was used for the epinephrine study (Appendix 2). It consisted of the following:

- An Admission Sheet which obtained information on weight, length, history of present illness, diet/fluids, current medications, patient history (including obstetric history, infectious diseases screening and immunization status),
developmental assessment, family history, social history, oxygen saturations on arrival

- A History and Physical Examination Sheet which was used to record examination findings and to list vital signs (temperature, pulse, respiratory rate and blood pressure)

- An Observation Sheet which was used for recording of vital signs and oxygen saturations as well as observations on the patient’s colour, cough status, recession index, behaviour, and breath sounds. It was also a record of whether oxygen was being administered and, if so, by what means (headbox, mask, or nasal prongs)

In addition, the following documentation was provided for staff:

- An oxygen guide for the bronchiolitis pathway
- An intravenous guide for the bronchiolitis pathway
- A stage A – in oxygen document
- A stage B – in air document
- A special needs report
- A variances report
- A discharge letter
- An information sheet for parents

A Pathway Assessment data collection form was used to collect data from the historical cohort group (Appendix 3). Data collected included:

- Length of stay
- Readmission within two weeks of discharge
- Need for oxygen and time spent receiving same
- Need for supplemental fluids (intravenous and nasogastric) and time spent receiving same
- Baseline clinical data—presence of chest recession, respiratory rate, and oxygen saturations on admission
- Pathology tests ordered
- Radiological tests ordered
- Parental smoking status
- Admission to ITU

These documents formed the basis for the collection of data on all infants in the study.

3.13 Data collection

Baseline clinical data including presence/absence of chest recession, respiratory rate, and oxygen saturations were collected from the emergency room notes for the historical control group and from the clinical pathway records in the pathway group. Naso-pharyngeal aspirate (NPA) results were obtained from the pathology database. In addition, data on the need for admission to the intensive care unit (ICU) during admission, and the smoking status of the parents were collected from review of the clinical records in the control group and from the clinical pathway for the pathway group. Data on all pathology tests ordered, the number of chest X-rays performed, and the use of antibiotics and steroids were also collected from the hospital databases and clinical records.

For the pathway group, infants who required supplemental oxygen, had weaned to air, and then required further supplemental oxygen prior to discharge from hospital were identified. The lack of documentation in the control group prohibited further investigation of infants who similarly were weaned to air and then required supplemental oxygen. The possible predictive factors that could account for this repeated requirement for supplemental oxygen were recorded including: hospital site, age, gender, RSV status, severity at admission (as determined by oxygen saturation, respiratory rate, and presence of recession), length of time of initial supplemental oxygen requirement, need for supplemental fluids, and parental smoking status.
All data was written on to the data collection form and then recorded in an electronic database. A missing value for any item was set to record as a missing value.

3.14 Conclusion

This chapter has described the development and implementation of the clinical pathway instrument used in this current study. In addition, this chapter has examined the specific data collection tools used as well as describing the study population and setting within which the study took place. The findings from the research will be described in the following chapter.
CHAPTER 4: RESULTS

4.1 Introduction

In order to determine whether or not the clinical pathway was effective in the management of infants with bronchiolitis, it was first necessary to establish that the two groups – i.e. the historical control group and the prospective clinical pathway group – had similar baseline demographic and clinical data. The data which were examined covered:

- the hospital to which the infant was admitted
- gender
- age
- respiration rate at admission
- saturations prior to the administration of oxygen
- presence of chest recession
- nasopharyngeal aspirate and, specifically, presence of the respiratory syncytial virus, and
- admission to the Intensive Care Unit.

It was important to establish that the two groups were similar in terms of these characteristics so that any differences in terms of outcomes such as length of stay, length of time in oxygen, need for supplemental fluids, or readmission within two weeks of discharge were not due to confounding factors associated with a dissimilar group. A descriptive analysis of this data is presented in Sections 4.2.1 to 4.2.8 and then summarised in Table 1. The outcomes for the patient, in terms of length of stay, length of time in oxygen, need for supplemental fluids, and readmission within two weeks is then presented in Sections 4.3.1 to 4.3.5. The same demographic and clinical
data identified as baseline characteristics of the two groups was then examined for possible predictive factors that could account for repeated requirement for supplemental oxygen. This data were analysed to identify if any were significant risk factors for the return of an infant to oxygen after they had been previously weaned. This examination of differences is based upon tests of association using Chi square and testing for statistical significance.

Next, this chapter presents comparative data on the smoking status of the parents, and the resource utilisation and drug usage of the two groups. The chapter concludes with a description of recorded variances for the group of infants managed on the clinical pathway.

4.2 Baseline Demographic and Clinical Data

4.2.1 Hospital Variation

In the historical control group, similar proportions of infants to those in the pathway group were randomly chosen from all four participating hospitals. Approximately 50% were from the Royal Children’s Hospital, Brisbane, while the remaining numbers of patients were distributed between the remaining three regional hospitals – approximately 21% from Gold Coast Hospital, 15% from Redcliffe Hospital and 14% from Caboolture Hospital, mirroring the reality of clinical presentation numbers to the emergency departments at these hospitals and ensuring that our patients were taken from a representative sample of the entire population at that time, and not merely from one catchment area. According to Wang et al. (1996) “it is likely that patients admitted to tertiary care hospitals will have more risk factors for severe disease....If differences among populations admitted to tertiary care hospitals are confirmed, outcomes of studies conducted at a single center may not be generalizable” (p391). To avoid just such an issue, the study results included both regional and tertiary paediatric settings.
4.2.2 Gender distribution

The gender distribution of the infant with bronchiolitis needed to be identified in an examination of differences between the pathway and the historical control group. It was important to ensure that the two groups compared had a ratio of boys to girls approximating those found in the general population who contracted bronchiolitis. The distribution of males to females remained consistent within the groups with approximately 63% of cases in both control and pathway groups being males. This result is consistent with published studies (Phelan et al., 1994) which indicate that males are twice as likely as females to contract bronchiolitis. Once again, this identified our groups as likely to be representative of the population contracting bronchiolitis in the general community. It also showed the two study groups to be similar in terms of gender distribution, so there was certainty that both time frames had representative samples.

4.2.3 Age at admission

Bronchiolitis is most common in infants less than 12 months of age, and those in the first six months of life are particularly likely to require hospitalisation (Fitzgerald & Kilham, 2004). For this reason, it was important that the age of infants in this study was similar to that of infants in the general community diagnosed with bronchiolitis. For both the control and the pathway infants, the mean age at the time of admission was just over 4 months (4.04 months for the control group and 4.43 months for the pathway group). The difference was not statistically significant and indicates that infants in this study were similar in age to infants in the general community hospitalized with this condition. This is important because there are significant changes in terms of respiratory rate and lung function as children grow which could
theoretically have an impact on the outcomes being examined in this study – particularly relating to oxygen requirements and length of stay. By identifying that the two groups were not significantly different in terms of their age, this factor was less likely to be a possible confounder.

4.2.4 Respiratory rate at admission

One of the most significant clinical indicators of the severity of bronchiolitis is that the infant becomes extremely dyspnoeic. If this respiratory distress reaches the point where the infant is unable to maintain satisfactory oxygen saturations or feed adequately, then hospitalisation is required. It is important when studying the effectiveness of an intervention – in this instance, use of a clinical pathway – that data was obtained on infants who were at the same level of “unwellness”. Failure to do so could result in one group being studied consisting of infants who were “well” relative to the other group being studied. In this study, there was no statistically significant difference in the mean respiratory rate at admission (50.73/minute for control infants and 51.69/minute for pathway infants). This is an important indicator of the severity of the illness, and the fact that it is similar for infants in both time periods under examination signifies that the cohort groups were matched in terms of baseline clinical data.

4.2.5 Saturations prior to Oxygen administration

In conjunction with the respiratory rate on admission, oxygen saturations are a significant indicator of the level of respiratory distress, and although “interpretation of pulse oximeter readings is not straightforward” (Schroeder, Marmor, & Newman, 2003, p1463”), they are still considered an essential observation when an infant presents with respiratory distress. For this reason, it was important to determine the
similarity between the two groups on this key measure of severity of illness. Once again, there was no statistically significant difference between the oxygen saturation on admission for the two groups with a mean of 93.1% for the control infants and 93.4% for infants managed on the pathway.

4.2.6 Chest Recession

In infants with bronchiolitis, three types of chest recession are noted – intercostal, subcostal, and substernal (Wainwright et al., 2003). If present, recession indicates that the infant is using some type of effort to maintain adequate respirations. The infants on the pathway were all given a severity ranking by the admitting nurse or doctor based on:

- the grading of their chest recession – absent, mild, moderate, or severe
- nasal flaring – absent, mild, moderate, or severe, and
- tracheal tug – nil, shallow, or deep.

For the purposes of this study, no attempt was made to quantify the amount of respiratory effort because, with an historical cohort, quantifying respiratory effort could be extremely inaccurate as the records often simply noted the presence or absence of recession. The assessor may have put “present +” or “++” when describing the recession, but there was no specific grading given. For this reason, it was only possible to look at whether there was any recession recorded at the time of presentation to hospital. The prospective group of pathway patients were all given a grading at the time of presentation. In the vast majority of infants, recession of some degree was present on admission (90.5% of control infants and 92.8% of pathway infants). Once again, there was no statistically significant difference between the two groups.
With the historical control group, the recording of the presence of chest recession was much more frequently done than the recording of nasal flaring or tracheal tug, so recession was the only indicator of respiratory effort used for study purposes.

Although recording of recession only was not an ideal matching of clinical data between the two groups, it still provided information on the infants’ clinical signs on presentation to hospital. This recession data allowed verification of the likelihood of a correct diagnosis, and was used in conjunction with all of the other clinical data to indicate the overall health status of the infant at the time of admission to hospital.

### 4.2.7 Nasopharyngeal aspirate

It was standard practice at all of these hospitals to obtain a nasopharyngeal aspirate (NPA) for detection of viruses, particularly the respiratory syncytial virus (RSV), the most common virus responsible for bronchiolitis. Collection and testing of an NPA both confirms the diagnosis and serves as a guide for infection control measures, because presence of the virus signals the need for isolation nursing. In both groups, the percentage of infants with a positive NPA was very similar (72.4% for control group and 75.3% for pathway group). Within this group of positive cases, the percentage of positive RSV results was almost exactly the same (66.1% for control group and 66.5% for pathway group). These differences were not statistically significant. It was important to establish that the number of positive cases was similar to confirm that the diagnosis was correct (although a negative result does not mean that the infant does not have bronchiolitis) for both cohort groups, and therefore the duration of the illness and the clinical outcomes of the infants should be similar.
4.2.8 Admission to Intensive Care Unit (ICU)

Because of the nature of bronchiolitis, there are always going to be a group of infants who have a severe case of bronchiolitis and require intensive care, often including ventilatory support (Numa, 2000). For these infants, the outcomes in terms of length of stay, need for oxygen, and requirements for supplemental fluid are going to be very different to the vast majority. The numbers requiring admission to ICU can vary quite considerably between hospitals and will be determined to some extent by the admission criteria for each individual hospital. For example, Peter and Fazakerley (2004), in their assessment of the management of infants with bronchiolitis reviewed the records of 210 patients, none of whom required admission to ICU. In contrast, Numa (2000), when looking at infants with RSV infection over three winter periods, stated that “approximately 10% of those hospitalized require intensive care” (p422). His study, however, particularly examined ICU admissions, and did not exclude infants with co-existing illnesses which are well documented to increase the morbidity and mortality from this disease (Fitzgerald & Kilham, 2004; Meissner, 1994; Phelan et al., 1994). Because this study had exclusion criteria for infants who had pre-existing cardiac or respiratory illnesses, the expectation was that the admissions to ICU would be for infants who were normally healthy. Looking at the percentage of infants who required ICU management, it was possible to verify that the two groups were similar in terms of severity of illness.

When considering a disease that has a seasonal and severity variation, it was important to ensure that data collected in a year with mild manifestations of the disease was not the only data used. Both groups for this study were examined over two winter seasons, and both had similar numbers that required admission to ICU. In the control group, 3.9% required admission to ICU, while in the pathway group 3.6%
were severe enough to warrant admission. Therefore, there was no significant difference between the two groups in terms of severity of cases (assuming that ICU requirement was essential for the most severe presentations). The similarity of numbers requiring admission to ICU meant that the impact on length of stay, need for supplemental oxygen, or intravenous fluids should be similar for both groups.
**TABLE 1: DEMOGRAPHIC DATA FOR INFANTS AT ADMISSION TO HOSPITAL**

Data given as mean (SD) unless indicated.

<table>
<thead>
<tr>
<th></th>
<th>CONTROL</th>
<th>PATHWAY</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(N = 207)</td>
<td>(N = 229)</td>
<td></td>
</tr>
<tr>
<td>Age (months) – mean (SD)</td>
<td>4.0 (3.0)</td>
<td>4.3 (2.9)</td>
<td>0.40</td>
</tr>
<tr>
<td>Gender (male/female) – N (%)</td>
<td>132 (63.8) / 75 (36.2)</td>
<td>141 (61.6) / 88 (38.4)</td>
<td>0.64</td>
</tr>
<tr>
<td>Nasopharyngeal aspirate +ve – N (%)</td>
<td>139 (72.4)</td>
<td>175 (76.4)</td>
<td>0.35</td>
</tr>
<tr>
<td>Respiratory Syncytial Virus +ve – N (%)</td>
<td>127 (66.1)</td>
<td>155 (67.7)</td>
<td>0.74</td>
</tr>
<tr>
<td>Admission numbers – N (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RCH</td>
<td>114 (55.1)</td>
<td>114 (49.8)</td>
<td>0.72</td>
</tr>
<tr>
<td>GCH</td>
<td>40 (19.3)</td>
<td>50 (21.8)</td>
<td></td>
</tr>
<tr>
<td>Caboolture</td>
<td>27 (13.0)</td>
<td>31 (13.5)</td>
<td></td>
</tr>
<tr>
<td>Redcliffe</td>
<td>26 (12.6)</td>
<td>34 (14.8)</td>
<td></td>
</tr>
<tr>
<td>Chest Recession present – N (%)</td>
<td>172 (90.5)</td>
<td>211 (92.1)</td>
<td>0.56</td>
</tr>
<tr>
<td>Respiratory rate (per min) – mean (SD)</td>
<td>50.7 (12.0)</td>
<td>51.8 (13.6)</td>
<td>0.41</td>
</tr>
<tr>
<td>O₂ saturations on arrival * – mean (SD)</td>
<td>93.1 (5.3)</td>
<td>93.4 (4.0)</td>
<td>0.48</td>
</tr>
<tr>
<td>Supplemental O₂ Requirement – N (%)</td>
<td>120 (58.0)</td>
<td>148 (64.6)</td>
<td>0.15</td>
</tr>
<tr>
<td>Admission to ICU – N (%)</td>
<td>8 (3.9)</td>
<td>7 (3.1)</td>
<td>0.64</td>
</tr>
</tbody>
</table>

* prior to commencement of oxygen

### 4.3 Outcomes

The current study identified that there was no statistically significant difference in the characteristics of the control and the pathway groups. Having established that fact, it was then necessary to examine the two groups for any possible differences in outcomes. Some of the clinical outcomes which indicate how an infant with bronchiolitis is responding to management of their care are:
- the length of stay, i.e. the time that the infant spends in hospital
- the length of time that the infant requires oxygen supplementation
- the length of time that the infant needs to spend receiving replacement fluids, and
- the requirement for readmission following discharge - in this study we used a time frame of 2 weeks.

Readmission may be an indication that the infant was discharged too early.

A descriptive analysis of outcomes is presented in Sections 4.3.1 to 4.3.5 and then summarised in Table 2.

**4.3.1 Length of stay**

There was no significant difference overall between the two groups for length of stay in hospital (LOS). The mean LOS for infants in the control group was 86 hours (75.3 – 96.6, 95%CI), and 88.6 hours (78.8 – 98.3, 95%CI) for the pathway group. The length of stay was 22.0 hours longer in a tertiary hospital (p=0.006), but this difference was reduced to 11.1 hours (p=0.064) after adjustment for supplementary oxygen and supplemental fluids.

**4.3.2 Length of time in oxygen**

58% of infants in the control group required supplemental oxygen for a mean time of 72.6 hours (59.9 – 85.4, 95%CI), while 65% of the pathway group required supplemental oxygen for a mean time of 79.9 hours (69.1 – 90.8, 95%CI). This difference in time, however, did not reach statistical significance. There was a significant difference, however, in a subgroup of both cohorts. Infants in the pathway group requiring oxygen only, had a longer length of stay (p=0.006) and a longer time in oxygen (p=0.003) than infants in the control group requiring oxygen only.
4.3.3 Need for Supplemental fluid

Supplemental fluids were administered to 34% of the control group compared with 19% of infants nursed on a pathway (P = 0.001), however more patients required supplemental fluids in tertiary hospitals than regional hospitals (28.9% v 16.3%, p=0.006)

4.3.4 Readmission

The number of infants with bronchiolitis requiring readmission is usually small (Phelan et al., 1994); for the pathway group there was only one infant (0.5%) who was readmitted within two weeks of discharge. In the control group, however, there were 15 readmissions (7.2%). This difference in the rate of readmission was significant. (p = 0.001).

4.3.5 Parental smoking status

The admission sheet for infants who were managed on the pathway collected data on the smoking status of the parents. Studies clearly illustrate that infants of smoking parents have a much higher risk of contracting bronchiolitis than infants with non-smoking parents (Reece, James, Landau, & Le Souef, 1992). The smoking status of parents of all 194 infants on the pathway was documented (N = 194, 100%), with 50% of parents identified as smokers. In contrast, data concerning parental smoking status were rarely collected (N = 33, 16%) prior to the introduction of the clinical pathway.

TABLE 2: OUTCOME MEASURES

Data given as mean (95% confidence interval) unless indicated.
### OUTCOME MEASURES

<table>
<thead>
<tr>
<th></th>
<th>CONTROL</th>
<th>PATHWAY</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(N = 207)</td>
<td>(N = 229)</td>
<td></td>
</tr>
<tr>
<td><strong>Length of stay (hours)</strong></td>
<td>86.0 (75.3 – 96.6)</td>
<td>88.6 (78.8 – 98.3)</td>
<td>0.72</td>
</tr>
<tr>
<td>Nil O₂ or supplemental fluids</td>
<td>40.2 (33.1 – 47.3)</td>
<td>34.4 (29.9 – 38.9)</td>
<td>0.18</td>
</tr>
<tr>
<td>O₂ only</td>
<td>81.5 (70.5 – 92.6)</td>
<td>107.0 (94.9 – 119.1)</td>
<td>0.006</td>
</tr>
<tr>
<td>O₂ and supplemental fluids</td>
<td>158.0 (132.5 – 183.5)</td>
<td>147.6 (115.7 – 179.4)</td>
<td>0.61</td>
</tr>
<tr>
<td><strong>Time in oxygen (hours)</strong></td>
<td>72.6 (59.9 – 85.4)</td>
<td>79.9 (69.1 – 90.8)</td>
<td>0.39</td>
</tr>
<tr>
<td>O₂ only</td>
<td>45.0 (35.0 – 55.1)</td>
<td>69.8 (58.7 – 80.9)</td>
<td>0.003</td>
</tr>
<tr>
<td>O₂ and supplemental fluids</td>
<td>101.1 (79.2 – 123.1)</td>
<td>106.4 (80.7 – 132.1)</td>
<td>0.77</td>
</tr>
<tr>
<td><strong>No. requiring supplemental O₂ – N (%)</strong></td>
<td>120 (58)</td>
<td>148 (64.6)</td>
<td>0.15</td>
</tr>
<tr>
<td><strong>No. requiring supplemental fluids – N (%)</strong></td>
<td>70 (33.8)</td>
<td>44 (19.2)</td>
<td>0.001</td>
</tr>
<tr>
<td><strong>Readmission within 2 weeks – N (%)</strong></td>
<td>15 (7.2)</td>
<td>2 (0.9)</td>
<td>0.001</td>
</tr>
<tr>
<td><strong>Parental smoking status known – N (%)</strong></td>
<td>33 (16)</td>
<td>229 (100)</td>
<td>0.029</td>
</tr>
</tbody>
</table>

### 4.4 Predictors for return to oxygen therapy

Forty infants (27%) on the clinical pathway required supplemental oxygen again after being weaned to room air. Boys were three times more likely to return to oxygen (OR = 3.30; 95%CI 1.39 – 7.81) after adjusting for oxygen saturations on admission, despite the fact that there was no significant difference between the admission oxygen saturations of boys and girls for the entire cohort. Eight hours of monitoring after weaning from oxygen resulted in only 14 (9.5%) requiring a return to oxygen therapy. For every 1% increase in admission oxygen saturations, the infant’s likelihood of returning to oxygen decreased by 16% (OR = 0.84: 95% CI 0.75 – 0.95). Of the infants who did require further supplemental oxygen, 80% had supplemental oxygen restarted between 6am and 6pm. Time to return to oxygen was not affected by sex, age at admission, or saturations on admission.
4.5 Resource Utilisation – Pathology Testing and Chest X-Rays

Some authors have suggested that a major benefit from the use of a clinical pathway is a decrease in the amount of test ordered and a subsequent reduction in costs relating to hospitalisation. Data on all pathology tests ordered and the number of chest X-rays performed were also collected from the hospital databases and clinical records.

The specific tests examined were:

- blood cultures
- arterial blood gases
- full blood counts
- urea and electrolytes
- liver function tests
- lumbar punctures
- MRSA screening
- urine culture and sensitivity.

Although the pathway was not prescriptive concerning the type of pathology or radiology tests to be performed, apart from an NPA, there was no significant difference between the two groups in terms of the number of chest X-rays or pathology tests done. The only significant differences in the amount of testing were for a few tests performed on a very small percentage of infants. Specifically, a higher proportion of patients in the control group (4%) had blood taken for Bordatella pertussis compared with the pathway group (0.87%) ($\chi^2 = 6.32; p = 0.012$). In contrast, a higher proportion of patients on the pathway (11%) had faeces culture and sensitivity testing done, compared with the control group (4%) ($\chi^2 = 7.23; p = 0.007$). Costs relating to pathology and radiology, therefore, are assumed to be
essentially the same in the two groups, although obviously costs would rise over time
in line with general operating cost increases.

4.6 Use of Drug therapy

Data on the use of antibiotics and steroids were also collected from the hospital
databases and clinical records. Peter and Fazakerley (2004) found a reduction in the
use of antibiotics, following introduction of a clinical pathway for bronchiolitis, as did
Wilson et al. (2002). The outcome of this study was a significant difference between
the pathway group and the control group in relation to the amount of steroid usage,
although the use of antibiotics was not significantly different between the two groups.
Drug therapy data is summarised in Table 3.
<table>
<thead>
<tr>
<th>DRUGS</th>
<th>CONTROL (N = 207)</th>
<th>PATHWAY (N = 229)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral steroids</td>
<td>15</td>
<td>4</td>
<td>0.005</td>
</tr>
<tr>
<td>Nebulised steroids</td>
<td>2</td>
<td>0</td>
<td>0.14</td>
</tr>
<tr>
<td>IV steroids</td>
<td>3</td>
<td>0</td>
<td>0.068</td>
</tr>
<tr>
<td>Oral antibiotics</td>
<td>12</td>
<td>14</td>
<td>0.89</td>
</tr>
<tr>
<td>IV antibiotics</td>
<td>18</td>
<td>18</td>
<td>0.75</td>
</tr>
<tr>
<td>Both Oral and IV antibiotics</td>
<td>8</td>
<td>5</td>
<td>0.30</td>
</tr>
</tbody>
</table>

### 4.7 Recording of Variances

There were a total of 268 variances recorded during the time of the current study. 203 of these related to infants on the Wainwright (2003) study; 65 related to patients who did not take part in the Wainwright study, but who were still managed on the clinical pathway. The overwhelming majority of the variances recorded (N=256) related to the patient, and, in most of these variances (85%), there was documentation that the infant had recorded a lower oxygen saturation than their previous recording. Almost all of the variances reported also identified action that was taken to correct the situation, such as the application of oxygen, an increase in the rate of oxygen flow, or the application of an apnoea mattress. Six variances were recorded as system errors, and six were identified as social factors, such as a mother being reluctant to take the infant home. No positive variances were recorded during the duration of the study.
4.8 Conclusion

This chapter has described the wide range of baseline demographic and clinical data that was collected on both the historical control group and the clinical pathway group. The importance of this data was that it allowed for the second phase of the data analysis which was a comprehensive comparison of the two groups to ensure that there were no significant differences between them which could affect our examination of identified outcomes. A discussion of the findings and their relevance is in the following chapter.
CHAPTER 5: DISCUSSION

5.1 Introduction

This chapter discusses the findings of the current study particularly in terms of the outcomes for both the control and the pathway groups. Implications for further research are also described.

5.2 Analysis of Outcomes

The two groups considered as part of this study were similar in terms of demographic data including age, sex, and admitting hospital. When considering the clinical features of both the pathway and the control group, there were no significant differences in terms of respiratory rate, presence or absence of chest recession, and oxygen saturations on admission. The characteristics of the two groups, therefore, were considered to be sufficiently comparable for the purpose of this study.

5.2.1 Lack of difference in terms of LOS and TIO

The lack of significant difference between the groups in terms of LOS or TIO suggests that either the particular clinical pathway used was not able to affect these outcomes, or that use of any clinical pathway may not significantly change these outcome measures for bronchiolitis. The longer length of stay for infants in the pathway group who required supplemental oxygen is likely to be due to the guidelines given for oxygen administration. The pathway was designed to be reasonable and acceptable to health care providers at a number of centres and the actual cut-off for an acceptable oxygen saturation for weaning had not previously been examined. The value chosen is likely to have an effect on both LOS and possible readmission and
should be formally tested. The subgroups of infants from the tertiary referral hospital who were hospitalised and in supplemental oxygen for longer periods of time would be expected as this was the centre to which the sicker infants were transferred as it was the only one with an ICU. It is more likely that use of the clinical pathway was not able to make a significant difference to the LOS or TIO for infants with acute viral bronchiolitis, due to the predictable course of the disease. Caution needs to be used, however, when using LOS as a determinant of patient outcomes as a shorter LOS does not necessarily mean quality healthcare (Todd, 2004).

5.2.1 Requirement for Return to Oxygen

Boys and infants with lower oxygen saturations on admission were the most “at-risk” group for requiring further supplemental oxygen after being previously weaned to room air. Males are thought to have smaller airways for their lung volume at this age, and so are potentially more likely to experience more severe or prolonged disease (Martinez, Morgan, Wright, Holberg, & Taussig, 1988). Earlier discharge of female infants, particularly with higher oxygen saturation on admission to hospital, may enable more efficient use of hospital services. In addition, the fact that significantly more infants returned to oxygen therapy during the day may lead us back to the cornerstone of bronchiolitis management, namely minimal handling and supportive nursing care. A greater number of activities such as feeds, physical examinations, and tests are conducted during the day, which could help explain the increased demands placed on vulnerable infants, resulting in oxygen desaturation and requirement for supplemental oxygen. At night, the status quo is much more likely to be maintained. The fact that less than 10% of infants required a return to oxygen after eight hours should allow for more accurate assessment of readiness for discharge and oxygen weaning protocol for nursing and medical staff.
5.2.2 Requirement for Supplemental Fluids

Another advantage to be gained from use of a clinical pathway may be a more accurate assessment of the infant in relation to their need for supplemental fluids. The criteria for the administering of supplemental fluids were specified for an infant on the pathway (if the infant was receiving supplemental oxygen, had a respiratory rate above 60 per minute, or was not taking adequate oral feeds), and this specified criteria may have had an effect on the decision as to whether or not to administer fluids. Similarly, the pathway specified that supplemental fluids were to be terminated when the infant was tolerating oral feeds. During hospitalisation of infants prior to the introduction of the pathway, i.e. during the time of admission of the historical control group, the decision concerning the administration of supplemental fluids was at the discretion of the emergency or ward doctor, and so was a matter of individual choice. Presumably such factors as the experience of the staff or the usual ward practice helped to determine whether supplemental fluids were given and, if they were, whether they were intravenous or nasogastric. These factors may have led to the administration of more supplemental fluids than was necessary and it almost certainly led to inconsistent decision-making by the staff. There was no evidence to suggest that a change in clinical practice relating to supplemental fluids, other than the introduction of the clinical pathway, occurred at the time of this study that could account for the significant difference between the two groups.

Pre-determined guidelines to direct clinical practice may lead to the elimination of some variability in practice and the avoidance of unnecessary invasive procedures for the patient. It may also be valuable as a cost-cutting measure, both in the up-front costs associated with naso-gastric and intravenous fluids and in terms of a reduction in the nursing time required in setting up and monitoring these procedures.
5.2.3 Requirement for Readmission

Within two weeks of discharge from hospital, 7.2% of the control infants had required readmission. This contrasts with only one pathway infant being readmitted within two weeks of discharge. Having established there was no difference in the length of stay or time spent in oxygen for infants managed on a pathway, and given that the infants in the pathway group were similar in terms of severity of illness to those in the control group, it may be that infants on the pathway were assessed more accurately about their suitability and readiness for discharge than had previously happened with control patients. The attainment of specified outcome measures prior to discharge is a concept endorsed in the literature (Kini et al., 2001).

A time frame of two weeks was determined as the cut-off point for re-admission and this time frame was based on the decision made by the staff participating in the Wainwright (2003) study. Any adverse reaction to the drug (epinephrine) that was administered during the Wainwright study was likely to happen within the two weeks following administration. In addition, the course of the disease meant that the infant with bronchiolitis would have respiratory signs for a period of only seven to ten days. By specifying a time frame of two weeks for re-admission, it was likely that all infants who may have had complications following their management or as a result of the drug administered were able to be identified. Wainwright et. al. argued that extending the time frame beyond two weeks would have allowed other factors, probably unrelated to either the drug administered or the illness itself, to intervene.

5.2.4 Parental smoking

When considering the scant data collected on parental smoking status of infants in the control group (16%), it appears that obtaining information on the smoking status of
parents is another aspect of the clinical pathway that has implications for care givers. The link between passive smoking and hospital admission for bronchiolitis has been established (Reece et al., 1992; Vogel et al., 2003; Woodward, Owen, Grgurinovich, Griffith, & Linke, 1987; Young, O'Keeffe, Arnott, & Landau, 1995), and it may well be that hospitalisation or follow-up post-discharge provides an opportunity to educate parents on the importance of preventative health measures, particularly in relation to passive smoking. The benefits of this education at the time of admission to hospital may be of dubious value (Fossum, Arborelius, & Bremberg, 2004; Irvine et al., 1999). However, some studies suggest that tackling smoking as an issue for the parent themselves may be a more effective strategy (Irvine et al., 1999; Wakefield, Reid, Roberts, Mullins, & Gillies, 1998) than linking it to the illness of their child. It appears to be notoriously difficult, though, to effect any long term change in smoking status, even when related to the health of a partner or a child (Chilmonczyk, Palomaki, Knight, Williams, & Haddow, 1992; Wakefield & Wilson, 1988; Woodward et al., 1987). Perhaps an option in the short term, at least, is that much more emphasis is placed upon reducing the exposure of children to any type of passive smoking by describing tobacco smoke as an environmental hazard. Giving examples of how this exposure can be minimized may also be useful. As a follow-on from that target, it may well be that “quit smoking” programs can be promoted throughout the general community. At least, the first step should be to identify families that may benefit from some future intervention. Documentation of this, prompted by the history sheet used in the clinical pathway, appears to be an excellent start. It will not be enough, however, and follow-up action is required (Boyle & Solberg, 2004). Further work to identify the extent of parental smoking and ways to minimize risks to their children is clearly needed.
5.2.5 Pathology and Radiology testing

There were few differences in the amount of pathology and radiology testing done between the groups, except for a few tests performed on a very small percentage of children. This lack of any difference suggests that clinical judgment used to determine the need for testing remains fairly constant and specific recommendations are probably required to affect the use of tests as has been previously shown by Muething et al. (2004). Certainly Peter and Fazakerley (2004) experienced a significant drop (28%) in the number of chest X-rays that were being performed following the introduction of an integrated care pathway for infants with bronchiolitis, and this drop in numbers was also found by Perlstein et al. (1999) following introduction of clinical guidelines for bronchiolitis. The outcomes of the study by Peter and Fazakerley in relation to pathology testing were similar to the results of this study in that testing did not change significantly following introduction of a clinical pathway.

Forrest et al. (2003) found a dearth of literature on what they call “effectiveness research” which they say “determines the effects of clinical intervention delivered in everyday medical settings on patient outcomes.” One area in particular that they mention relates to tests and procedures:

Health care practitioners need much more information on the effectiveness of diagnostic test and therapeutic procedures as they are applied to children and adolescents. Many of the newer diagnostic modalities are likely to improve diagnostic accuracy. Whether improvements in diagnostic accuracy in clinical samples translate into improvements in population health is the sort of information that health care practitioners and delivery systems require to practice cost-effective medicine (p180).

5.2.5 Drug Therapy

The significant difference between the two groups in relation to the use of steroids aligns with findings by Peter and Fazakerley (2004) that clinical pathways are
effective in changing the pattern of drugs being prescribed for bronchiolitis, although this ability to change the pattern may only relate to where specific guidelines for management are given. The pathway used for this study had a section on drug guidelines, which included a sentence suggesting that routine use of steroids was not warranted and should be reported as a variance. Some authors have suggested that such guidelines are not enough to change clinical practice (Barben et al., 2000), however, Muething et al. (2004) were able to identify a marked drop in the use of bronchodilator therapy for the management of patients with bronchiolitis by establishing clinical guidelines which commenced in the emergency department. The reduction in the use of steroid therapy that occurred in this study while the patient LOS was unaltered and readmission rates to hospital dropped, suggested that this change in drug prescribing practice had no detectable negative effect on short term patient outcomes.

The prescription of antibiotics during admission, however, is not as clear-cut. Wilson et al. (2002) found that antibiotic use dropped after the introduction of a clinical pathway. For this study, antibiotic use remained constant after the introduction of the pathway, possibly because they were already being prescribed judiciously and possibly because there were no specific guidelines given for antibiotic usage in this pathway. Perlstein et al. (1999) found a similar result. Wang et al. (1996) described the variations in interventions relating to both steroids and antibiotics, suggesting that variations can occur when the most appropriate management is not clear.

5.2.6 Recording of Variances

The outcome of the evaluation of the variances recorded was in direct contrast to findings reported by de Luc (2000) who commented “the variance reporting system
was rarely used and the results were not fed back to the clinical staff” (p491).

According to her findings, all negative comments about use of a clinical pathway related to pathway documentation and its time consuming nature (de Luc, 2000). Smith and Gow (1999) also reported difficulties with documentation by nursing staff. In this study, there was a significant level of recording of variances, to the extent that most were, in fact, not variances. An infant may have had a change in their oxygen saturations, and so could have been placed on oxygen or had their level of oxygen increased or decreased. The infant’s condition may then have been stable for some time before they, once again, required another change in the amount of supplemental oxygen they were receiving. This, in effect, was a normal part of the disease process and did not need to be recorded as a variance. The clinical pathway had documentation advising when oxygen levels were to be increased or decreased. A variance would be such things as the development of signs of infection or vomiting following feeds. These signs would indicate that there was some new patient problem that required attention. This high level of reporting of variances suggested a level of anxiety of the staff who were concerned about adequately documenting changes in the infants’ condition. This apparent anxiety aligned with findings by various authors (Lau et al., 1996; Scott, 1995) who also discuss the confusion and concern of staff relating to variances. Although the nursing staff recognized that a variance occurred, the actual reason for the variance required a subjective assessment on their part, so there was always an element of uncertainty about how these would be documented.

5.3 Implications

The implications of this study are that a clinical pathway alone may not have a significant impact on patient outcomes such as length of stay or time spent in oxygen. Bronchiolitis is generally a self-limiting disease, so it may not be a clinical condition
that will be altered simply by placing the infant on a clinical pathway upon presentation to a hospital. Perhaps other conditions which have different disease processes are more responsive to management by clinical pathways, and this responsiveness may be why children with other respiratory conditions such as asthma are reported to have had positive outcomes (Johnson et al., 2000; Kelly et al., 2000).

One of the major benefits of using this clinical pathway for infants with bronchiolitis appeared to be in assessment of readiness for discharge and reducing required readmissions through the achievement of specified clinical outcomes prior to discharge. This aligns with current findings by Meuthing et al. (2004) and others, that emphasise the importance of having specific guidelines, including admission and discharge criteria, which direct clinical practice.

While the clinical pathway may not change the length of stay, there may be other ways that it impacts on the care of the infant with bronchiolitis. It may increase the level of discernment with which diagnostic testing is done – for example, if infants tend to get better regardless of whether they have a full blood count or a chest X-ray, then the fact that they recover anyway may well be a reason to reconsider the necessity of these investigations. Not only is there the cost of the testing to consider, but there is also the invasive nature of the tests when they may add nothing to improving outcomes for the infant. The tests may only be confirming a diagnosis which may be useful, but is it necessary? Antonow et al. (1998) stated that “the costs of a sepsis evaluation outweigh the benefits in infants with obvious bronchiolitis” (p231).

Similarly, the use of a clinical pathway may allow health professionals to more carefully consider the infant’s need for supplemental fluids. Are there clear
indications for supplemental feeds based on specific evidence? If not, perhaps there is no need to perform invasive procedures such as insertion of nasogastric tubes or intravenous cannulation. Justifying the use of these procedures should be a prerequisite to performing them. As Wang et al. (1996) point out: “recognizing that all interventions use resources and have a risk of associated side effects, the need to determine their efficacy… is obvious” (p394).

Obtaining information on the smoking status of parents is another aspect of the clinical pathway that has implications for care givers. It provides the opportunity to educate parents on the importance of preventative health measures, particularly in relation to passive smoking.

One implication from this research is the reconsideration of the level of education into the management and recording of variances in the light of these findings. The education given failed to provide staff with adequate information to use the clinical pathway to its full extent. Further work on how to provide more effective education programs is clearly required.

Although the clinical pathway is no longer used in the tertiary hospital, it is still being used in the three regional centres and this is probably because the specific criteria developed at the local level provide guidance in these hospitals that do not have large numbers of experienced paediatric staff. Ongoing support by clinicians and hospital administrators for clinical pathways as a management tool was not forthcoming in the tertiary hospital, possibly because its advantages were not easily apparent. The implications of this study are that there are, in fact, some advantages to using clinical pathways in that we can change clinical practice by providing practitioners with clear guidelines which support their practice. The challenge is to
ensure that these guidelines are evidence based and achieve the best possible outcomes for patients.

5.4 Conclusion

The clinical pathway provided a systematic way of managing the care of infants with acute viral bronchiolitis. The important outcomes of decrease in LOS and TIO, which could have resulted in significant cost benefits, were not evident. What did emerge, however, was that the areas in which specific recommendations were identified in the clinical pathway were the areas where there were statistically significant differences in outcomes between groups. This is evidenced by the reduction in the administration of supplemental fluids and steroids and the consistent collection of data on parental smoking status. When auditing the clinical notes to obtain information relating to these outcomes, it was very apparent that documentation for the pathway group provided much more comprehensive data than that which could be obtained for the control group. This improvement in the collection of data, in itself, is significant when considering the call for evidence-based practice. All of these factors confirm the findings of others, such as Meuthing et al. (2004), that there are significant benefits to adopting a planned approach, either by the use of clinical guidelines or a clinical pathway, to the care of infants hospitalised with bronchiolitis. Grimshaw and Russell (1993), after a significant review of a large number of clinical guidelines, stated that “The conclusion is that explicit guidelines do improve clinical practice in the context of rigorous evaluations” (p1321).
CHAPTER 6: CONCLUSION

6.1 Introduction

This chapter draws conclusions from the current study, identifies some limitations from the study and suggests recommendations for the future.

6.2 Conclusions

The present study sought to examine the development and effectiveness of a clinical pathway in the management of infants admitted to hospital with bronchiolitis. This evaluation of the clinical pathway examined very specific quantitative outcomes such as length of stay, time in oxygen, need for readmission, need for supplemental feeds, and drug therapy. It also looked at factors that may have been significant in determining whether an infant needed to be returned to oxygen therapy. All of the findings were evidence-based and directly relevant and applicable to health professionals in the clinical area. The purpose of the study was to provide evidence regarding whether use of a clinical pathway leads to better clinical outcomes for infants with bronchiolitis. The findings suggest that when clear guidelines are given better outcomes can result.

The first aim of the study was to compare clinical outcomes of infants in the pathway group with infants in the control group. We were able to show that the baseline demographic and clinical data of the two groups were similar, and that there was no significant difference between the two groups in terms of two important clinical outcomes – namely LOS and TIO. The requirement for supplemental fluids and readmission to hospital were, however, significantly different.
Another objective, to provide information on the comparative use of pathology, radiological investigations, and medications between the two groups, clearly identified different practices in the administration of medications, although the use of pathology and radiology was similar.

Finally, the objective to identify predictors for return to oxygen therapy for infants in the pathway group, was able to establish the greater likelihood of an infant requiring a return to oxygen in the daylight hours. This is particularly true for boys and infants with lower oxygen saturations on admission.

The outcomes identified suggest that there are significant benefits to adopting a planned approach, either by the use of clinical guidelines or a clinical pathway, to the care of infants hospitalised with bronchiolitis.

6.3 Limitations

While the use of a historical control group is not ideal, prospectively randomising patients to pathway care or not pathway care would be extremely difficult from the point of view of nursing education and adherence with pathway use. As one writer comments, when discussing research involving two simultaneous clinical areas where one is the control and the other is the intervention area: “It is incredibly difficult to measure effects, introduce a consistent approach to change and avoid any alteration in the comparison ward” (McKenna, 1993, p46). Grimshaw and Russell (1993), when looking at a review of clinical guideline evaluations also discuss the difficulties inherent in the study of two groups. They comment
randomised trials are the most robust method of assessing most health care innovations, but in evaluating guidelines there is a danger that treatment offered to the control patients will be contaminated by doctors’ knowledge of the guidelines, leading to underestimates of the true effects of guidelines. Studies where doctors (or hospitals) are randomised are at risk of a different bias: those randomised to the guidelines group may be subject to a greater Hawthorne effect (the beneficial effect on performance of taking part in research) than controls, with the result that the evaluation may overestimate the true effects of guidelines (p1317-8).

Use of an historical control group, then, was seen as a way of reducing this bias, although it did limit the availability of some pieces of information. Kelly et al. (2000) also acknowledged the limitation of using an historical control group when reviewing an asthma clinical pathway, but considered it less subject to bias than two prospective groups, one using a pathway and one not.

This study was conducted in a variety of hospital settings that allowed larger numbers, and also ensured that the study participants were likely to be representative of most infants hospitalised in either tertiary or regional hospitals. Seasonal variation occurs with bronchiolitis leading to significantly greater numbers presenting during the winter months. By accessing medical records for the historical control group in the same seasonal time period as that of the Wainwright (2003) study, any such difference was taken into consideration. Genotype variations in the causative organisms for bronchiolitis can mean that one year might result in milder cases than in a subsequent year, theoretically resulting in shorter LOS or reduced TIO. By collecting data over two winter periods, the possibility of such an occurrence was minimized. In addition, severity data suggested similar groups were studied.

When attempting sub-group analyses of the data by individual hospitals, the length of stay and time in oxygen were the only measurements that could provide meaningful data. For example, the number of infants at any one hospital who had been
administered particular drugs was very small and so to identify variations in inter-
hospital administration could be misleading. Despite having overall numbers of 200
in each group, the limitations of the analysis when breaking some data down in to
sub-groups became obvious.

The data, collected largely by nursing staff, was documented in the clinical area while
they were caring for infants hospitalised with bronchiolitis. As such, there was
always going to be some data missing or incomplete. This is particularly true when a
new method of care, including new documentation, is introduced, as was the case with
the introduction of the clinical pathway. In these situations, there was also the element
of individual clinical judgement which influenced decision-making and reporting,
even within the framework of a clinical pathway.

Infants who are unwell do not always behave as predicted. Despite details of the
expected or usual pattern of illness and outcomes, there were instances where the
infant’s condition fell outside normal parameters. The incidence of documented
variances confirmed this departure from “normal”. The fact that many of the
variances were, in reality, a normal part of the disease process suggested that
education of staff was less than ideal.

As Mc Kenna (1993) commented, “Most research studies in nursing are liable to
certain limitations because their field of interest is human activity which, by
definition, is an unpredictable area of investigation” (p46). This research study was no
exception.

Despite these limitations, however, this study identified the need to think creatively
and act in unison, as part of a health care team planning for change if progress leading
to improved patient outcomes is to be made.
6.4 Recommendations

Further to the above discussion of the findings generated by this study, several recommendations are made:

6.4.1 Research Recommendation 1:
Clinical pathways and practice guidelines for other clinical conditions should be formally evaluated to ensure that identified outcomes have been met.

6.4.2 Research Recommendation 2:
A formal evaluation of the effectiveness of minimal handling as a significant part of the care of infants with bronchiolitis should be carried out.

6.4.3 Clinical Recommendation 1:
Clinical guidelines on drug administration should be established for the management of infants with bronchiolitis.

6.4.4 Clinical Recommendation 2:
Parental smoking status should be recorded so that these individuals can be specifically targeted in strategies aimed at minimizing the exposure of infants to smoking.
REFERENCES


APPENDIX 1: PRE-IMPLEMENTATION

EVALUATION of CLINICAL PATHWAY
PRE IMPLEMENTATION EVALUATION BRONCHIOLITIS PATHWAY

PATHWAY QUESTIONS

PLEASE COMPLETE THE FOLLOWING QUESTIONNAIRE. PLACE YOUR ANSWER IN THE BOX AT THE SIDE OF THE QUESTION

PLEASE TICK THE BOXES BELOW TO INDICATE YOUR PROFESSIONAL STATUS

CONSULTANT ☐ DON ☐ REGISTERED NURSE ☐
REGISTRAR ☐ NPC ☐ CLINICAL NURSE ☐
RESIDENT ☐ CNC ☐ ENROLLED NURSE ☐

DATE ____/____/20__

☐ 1. What are clinical paths?
   a. a single plan that clearly defines the expected progression of a patient through the hospital system
   b. integration of medical treatment protocols, nursing care plans & the activities of allied health professionals
   c. a plan that outlines the sequence of desired interventions for specific case types
   d. all of the above

☐ 2. The key components of clinical paths include:
   a. medication sheet, variances, fluid balance charts
   b. allied health history, medical history, nursing history
   c. special needs, variances, accurate care plan
   d. medication sheet, nursing history, medical history

☐ 3. What is a variance?
   a. an instruction on the clinical path
   b. a project sheet
   c. discharge criteria
   d. a documented change in the prescribed care plan

☐ 4. Variances should:
   a. be documented & addressed as soon as they occur, include the action to be taken & outcome
   b. be used as a quality improvement tool
   c. include the nature of variance, why, when & who
   d. all of the above

☐ 5. What are your responsibilities if a patient develops a variance?
   a. Nothing
   b. complete documentation, patient’s progress is temporarily disrupted & may/may not continue on the path
c. complete documentation, advise appropriate health care teams, actively participate in a plan of action, & patient may/may not continue on the path
d. discharge to care of parents

6. **Sources of variance can be:**
   a. patient/family eg social issues, clinical eg medical officer omission
   b. discharge planning and community eg lack of education for family
   c. system eg lack of resources
   d. all of the above

7. **What is a special need?**
   a. a co-morbidity or condition that the patient has on discharge apart from the diagnosis
   b. a co-morbidity or condition that the patient has on admission apart from the diagnosis
   c. occurs under 1 year of age
   d. represents the difference between what is expected to occur during the patient’s episode of care and what actually happens

8. **Who is responsible for documenting on the path**
   a. medical staff
   b. nursing staff, allied health
   c. medical, nursing staff
   d. all staff using the pathway

9. **The benefits of using clinical paths are:**
   a. reduction in paperwork, reduction in variation in care, strengthens multidisciplinary collaboration
   b. elimination of redundant interventions, decrease in observations, strengthens multidisciplinary collaboration
   c. enhances discharge planning, variation in care, cost containment of health services, reduction in paperwork
   d. reduction in variation in care, reduction in paperwork, increases variances, defines special needs
APPENDIX 2: CLINICAL PATHWAY

DOCUMENTATION
INSTRUCTIONS FOR PATHWAY

- Record AM/PM/ND as appropriate at the top of each column (AM = 0700-1530, PM = 1300-2130, ND = 2100-0730)
- Each stage the relevant staff member should tick in the space provided. If an activity is NOT APPLICABLE please indicate by recording N/A.
- Each shift the nurse responsible for care will sign the appropriate box. If the activity is relevant for the child but is achieved before or after expected, indicate as a VARIANCE by recording VAR on the path and record on the Variance sheet, indicating, WHAT HAPPENED? WHY? WHAT DID YOU DO ABOUT IT? & OUTCOME.

ON ADMISSION: Medical Officer
- Order Paracetamol and N/Saline nasal drops on medication chart
- Complete NPA request form
- Document NPA results on the Drs admission sheet of path when available

ON DISCHARGE:
1. Complete discharge summary
2. Give discharge advice

DETERIORATION IN CONDITION: If patient deteriorates, eg from stage B to stage A:
- *Indicate VAR in box, and record reason why on variance tracking sheet
- *Document date and time, stage recommenced at top of relevant column
- *Continue on path from this point as usual.

The Path is designed to assist clinicians by providing a framework of expected care. The Path is not intended to replace a clinician’s judgement. If an individual patient does not fit the clinical outline contemplated then the path should not be used to guide care.
ROYAL CHILDREN'S HOSPITAL (provisional diagnosis of bronchiolitis has been made)

ADMISSION SHEET FOR BRONCHIOLITIS PATHWAY

N.P.A RESULT

Randomisation Number

Affix identification label

Weight: ____________________________ Length: ____________________________

DATE: _____/_____/2000 Time: _____am/_____pm

History of present illness

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<th>Comments</th>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difficulty breathing</td>
<td>N</td>
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Other (specify) ______________________________________________________

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<tr>
<td>Bottle</td>
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<tr>
<td>Solids</td>
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Is talking orally (>1ml) 2/0maintenance fluids

Yes ( )

No ( ) specify amount in last 24hrs: __________mls

Current medication

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If not complete specify: ________________________________________________

Patient History

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Previous medical problems

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Immunizations

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<td>4 months</td>
<td>Y/N</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Months</td>
<td>Y/N</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>12 Months</td>
<td>Y/N</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>18 months</td>
<td>Y/N</td>
<td></td>
<td></td>
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</tbody>
</table>

If not complete specify: ________________________________________________

Allergies

<table>
<thead>
<tr>
<th>Allergy Type</th>
<th>Y/N</th>
<th>Initials/Name</th>
<th>Date of onset</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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Developmental Assessment

<table>
<thead>
<tr>
<th>Milestones according to age</th>
<th>Y/N</th>
<th>Initials/Name</th>
<th>Date of onset</th>
<th>Comments</th>
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</thead>
<tbody>
<tr>
<td></td>
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Family History

<table>
<thead>
<tr>
<th>Relative Type</th>
<th>Y/N</th>
<th>Initials/Name</th>
<th>Date of onset</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atopy in first degree relatives</td>
<td>Y/N</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
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</table>

Social History

<table>
<thead>
<tr>
<th>Habit</th>
<th>Y/N</th>
<th>Initials/Name</th>
<th>Date of onset</th>
<th>Comments</th>
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</thead>
<tbody>
<tr>
<td>How many cigarettes does the mother smoke/day</td>
<td>Y/N</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>non smoker</td>
<td>Y/N</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>During pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Father</td>
<td>Y/N</td>
<td></td>
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Any other relevant social issues please document in chart

According to findings

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<thead>
<tr>
<th>Finding Type</th>
<th>Y/N</th>
<th>Initials/Name</th>
<th>Date of onset</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>SaO2 under 94% administer O2</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
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</tbody>
</table>

SaO2

<table>
<thead>
<tr>
<th>% before O2</th>
<th>O2 administered</th>
<th>Date of onset</th>
<th>am/pm</th>
<th>_____/2000</th>
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<tbody>
<tr>
<td></td>
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</table>

If O2 is required and RR > 60

<table>
<thead>
<tr>
<th>Commence LV fluids</th>
<th>Y/N</th>
<th>Initials/Name</th>
<th>Date of onset</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>LV fluids administered</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If N.G is used record as variance

<table>
<thead>
<tr>
<th>Date of onset</th>
<th>am/pm</th>
<th>_____/2000</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

ABOUT USE OF DRUGS

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<thead>
<tr>
<th>Drug Type</th>
<th>Y/N</th>
<th>Initials/Name</th>
<th>Date of onset</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do not use bronchodilators (salbutamol and/or ipatropium)</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tbody>
</table>

If there are no exclusion criteria and parents agree to be in the trial, obtain a signed consent. If insufficient time in D.E.M ask ward RMO/REG to obtain consent. Obtain a randomisation number. Study medication to accompany patient to the ward.

Date and time patient is ready to go to the ward: __________am/pm. _______/2000

N.P.A Requested: Y/N

Name: ____________________________

Signature: ________________________
<table>
<thead>
<tr>
<th>Admission Sheet For Bronchiolitis Pathway</th>
<th>Randomisation Number</th>
<th>Affix Identification Label</th>
</tr>
</thead>
</table>

**History and Physical Examination**

<table>
<thead>
<tr>
<th>Field</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulse</td>
<td></td>
</tr>
<tr>
<td>R.R.</td>
<td></td>
</tr>
<tr>
<td>B.P.</td>
<td></td>
</tr>
<tr>
<td>Temp.</td>
<td></td>
</tr>
<tr>
<td>DATE</td>
<td>TIME</td>
</tr>
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</tbody>
</table>

**COUGH STATUS**

- N = Nil
- D = Dry
- O = Occasional
- M = More
- B = Bubby
- P = Pervious

**OXYGEN MODE**

- HB = Humidifer
- NP = Nasal
- Prong
- M = Mask
- Y = Yes
- N = No

**BREATH SOUNDS**

- W = Wheeze
- S = Stethor
- C = Crackles
- G = Gurgling
- Pt = Pink
- D = Dusky
- P = Paller / Pale

**RECESSION**

- 0/1/2
- Grade 0
- Grade 1
- Grade 2
- Grade 3

**OBSERVATION**

- PN = Pre Neb
- A = Awake/Settled
- P30-60 = 30 mins post Neb
- I = Irritable
- P60-60 = 60 mins post Neb

**RECESSION**

- Increase
- Decrease
- Normal
OXYGEN GUIDE FOR BRONCHIOLITIS PATH

Indications for applying Oxygen
NOTE: If any of the signs & symptoms listed below are present O2 may be needed.
  Respiratory distress = Grade 2 symptoms (Refer Observation chart)
  Significant respiratory distress when feeding
  Exhibiting altered state of consciousness
    eg more lethargic or more irritable according to parents observations
  Oximetry <94% consistently
  Feeding Poorly [Less than two-thirds maintenance fluid requirements
    (Refer to table below)]

**FEEDING REQUIREMENTS - ORAL**

<table>
<thead>
<tr>
<th>Age</th>
<th>Feeding Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 9 months</td>
<td>120-140 mls/kg/day</td>
</tr>
<tr>
<td>9-12 months</td>
<td>90-100 mls/kg/day</td>
</tr>
</tbody>
</table>

Weaning Oxygen
If respiratory status stable:
  - In the current level of O2 for 4 hrs
  - Feeding without becoming distressed = grade 1 symptoms
  - Hydrated
  - SaO2 >93

Weaning Oxygen - NASAL PRONGS [USE LOW FLOW METER]
  - O2 weaned off at 0.25L/min 4th hourly until child reaches air or
    reaches the usual supplemental O2 requirement
  - It may be necessary to put the child on O2 for feeding if signs of Respiratory distress
    (Grade 2 symptoms)
    - Place in 0.5 - 1L/min O2 via nasal prongs, or 4L mask
    - Remove O2 30mins post feed if RR stable

Weaning Oxygen - HEAD BOX
  - O2 weaned off at 5% until child reaches 21% O2 requirement
  - Stable in the current level of O2 for 4 hrs
  - If switching to nasal prongs see table for conversion from L/minute to %

Weaning Oxygen - MASK
  - O2 weaned off at 1L 4th hourly until 4L is reached
  - If child requires O2 at <4L/min switch to nasal prongs
    (see table for conversion from L/minute to %)
  - O2 is often used intermittently during the illness as respiratory state changes

**TABLE OF CONVERSION FROM % TO L/min**

<table>
<thead>
<tr>
<th>OXYGEN FLOW</th>
<th>FiO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>L/min</td>
<td>(%)</td>
</tr>
<tr>
<td>0.5</td>
<td>43</td>
</tr>
<tr>
<td>0.4</td>
<td>38.6</td>
</tr>
<tr>
<td>0.3</td>
<td>34.2</td>
</tr>
<tr>
<td>0.2</td>
<td>30</td>
</tr>
<tr>
<td>0.1</td>
<td>25.4</td>
</tr>
<tr>
<td>0</td>
<td>21</td>
</tr>
</tbody>
</table>

*Guide & applicable up to 10kg weight limit*
**INTRAVENOUS GUIDE FOR BRONCHIOLITIS PATH**

If bung inserted for bloods do not commence IV fluids unless indicated

**Indications for commencing IV Fluids**
- Resps >60 plus O2 requirement
- Feeding Poorly/Not feeding
- Lethargy

**Combination of above**

**Reducing IV Fluids**
If respiratory status stable
- Oxygen requirement decreasing
- Feeding without becoming increasingly distressed
- Tolerating feeds orally
- Wean IV fluids according to ability to tolerate oral feeds

**Ceasing IV Fluids**
If Patient remains stable for 6 hours and tolerating good feeds:
- Contact medical officer about ceasing IV fluids
- Flush 4 hourly as per medical orders
- Should IV fluids not be required, do not remove bung until medical orders are given

**Removal of IV bung**
- Contact medical officer before removal of bung

**Guidelines for care of IV**
- Follow usual hospital protocol for IV care
- If iv is running check site hourly
- Observe site for redness, warmth & swelling
- Fluid balance chart
<table>
<thead>
<tr>
<th>STAGE  A – IN OXYGEN</th>
<th>Record date &amp; time commenced in O2 (obs chart). Refer ‘O2 Guide’ if applicable.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>/ /2000 / hours <strong>INDICATE SHIFT</strong></td>
</tr>
</tbody>
</table>

**All patients:**
- Assess skin turgor, color & peripheral circulation; record on obs chart (head to toe assessment)
- Assess recession, document severity and location (obs chart)
- Assess patient behavior, document (obs chart)

<table>
<thead>
<tr>
<th>NURSING RESPIRATORY ASSESSMENT</th>
<th>If unstable: Notify RMO if condition deteriorates or requiring increase in O2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Record PR, RR &amp; SaO2 1 hrly &amp; T^1 hrly (obs chart)</td>
</tr>
<tr>
<td></td>
<td>If Febrile: T^1 hrly</td>
</tr>
<tr>
<td></td>
<td>Place on SaO2 machine &amp; monitor continuously. Record hourly</td>
</tr>
</tbody>
</table>

If stable - Commence Weaning:
- Record PR, RR1 hrly & T^1 hrly (obs chart). If febrile T^1 hrly
- Record SaO2 1 hrly (obs chart)

**MEDICAL (DOCTORS)**
- Order O2 as per respiratory assessment. Refer ‘O2 Guide’
- Review patient in O2 at least twice daily
- Order IV Therapy if required
- Write up feeding requirements

**INVESTIGATION**
- Obtain NPA specimen
- Record NPA results

**TREATMENTS**
- O2 requirements as per respiratory assessment. Refer ‘O2 Guide’
- IV insitu and patent (if applicable)

**MEDICATION**
- Give medications as per Medical orders

**NUTRITION**
- Maintain fluid balance chart
- Give feeds as per Medical orders

**HYGIENE**
- Maintain general hygiene

**DEVELOPMENT**
- Ensure appropriate stimulation therapy

**EDUCATION**
- Explain ward layout & give orientation folder to parents
- Give Bronchiolitis parent/caregiver education leaflet & discuss
- Explain treatment, procedures and equipment **as required**
- Discuss importance of minimal handling with parents/caregiver
- Discuss Infection Control with parents/caregiver
- Discuss with parents expected plan of care using path as a guide

**CRITERIA TO START WEANING OXYGEN**
- Respiratory status stable in current O2 level >4hrs. Refer O2
- Airway patent
- SaO2 > 93 % in O2
- Tolerating fluids
- Voiding
- Notify RMO if infant meets criteria for weaning O2.
- Wean O2 as per O2 guide

**INTERMEDIATE OUTCOMES**
- Respiratory status stable
- Airway patent
- SaO2 > 93 % in O2
- Tolerating fluids
- Voiding
- Patient behaviour assessment indicates patient is comfortable
- Medications given as per Medical orders
- IV checked and patent *(If present)*
- Parents understand treatment plan & expected length of stay
- Parents understand unit layout
- Infection control principles followed by parents/caregivers
- Immunisation status documented on Immunisation Record

**OUTCOMES**
- Progress to stage B - IN AIR when:
  - respiratory status stable in 0.25L O2 for >4-6 hours
  - feeding well
  - RMO notified of progress
SIGN ON REVIEW - CARE TO CONTINUE AS PER PATH
THE SIGNATURES BELOW REFLECT THE CARE GIVEN FOR ‘STAGE B – IN AIR’ DURING EACH SHIFT

<table>
<thead>
<tr>
<th>VARIATION DATE, TIME</th>
<th>Date:</th>
<th>Yes [ ] No [ ]</th>
<th>Date:</th>
<th>Yes [ ] No [ ]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shift:</td>
<td>Yes [ ] No [ ]</td>
<td>Date:</td>
<td>Yes [ ] No [ ]</td>
<td></td>
</tr>
<tr>
<td>Shift:</td>
<td></td>
<td>Yes [ ] No [ ]</td>
<td>Date:</td>
<td>Yes [ ] No [ ]</td>
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</table>

<table>
<thead>
<tr>
<th>NURSING DATE, TIME</th>
<th>Date:</th>
<th>Print Name &amp; Sign</th>
<th>Time:</th>
<th>Print Name &amp; Sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIGNATURE</td>
<td>Date:</td>
<td>Print Name &amp; Sign</td>
<td>Time:</td>
<td>Print Name &amp; Sign</td>
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</table>

<table>
<thead>
<tr>
<th>MEDICAL DATE, TIME</th>
<th>Date:</th>
<th>Print Name &amp; Sign</th>
<th>Time:</th>
<th>Print Name &amp; Sign</th>
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</thead>
<tbody>
<tr>
<td>SIGNATURE</td>
<td>Date:</td>
<td>Print Name &amp; Sign</td>
<td>Time:</td>
<td>Print Name &amp; Sign</td>
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</tbody>
</table>

Refer to Oxygen & IV Guide for Bronchiolitis Path  refer to Infection Control Policy
### STAGE B – IN AIR

<table>
<thead>
<tr>
<th>Date &amp; time commenced in air</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>/</strong>/2000  ________ hours</td>
</tr>
</tbody>
</table>

#### NURSING

**All patients:**
- Assess skin turgor, color & peripheral circulation; record on obs chart (head to toe assessment)
- Assess recession, document severity and location on obs chart
- Assess patient behavior, document (obs chart)

**If unstable:**
- Record PR, RR & SaO2 1 hrly & T°4 hrly on obs chart
- Febrile T°1 hrly
- Continuous SaO2 monitoring & record hourly
- Contact RMO/Registrar

**If stable:**
- Record PR, RR 2 hrly & T° 4 hrly (obs chart). Febrile T°1 hrly
- Record SaO2 2 hrly (obs chart)

#### RESPIRATORY ASSESSMENT

#### INVESTIGATION

Obtain NPA specimen
Record NPA results

#### MEDICATION

Give medications as per Medical orders

#### NUTRITION

Maintain fluid balance chart
Give oral feeds as tolerated

#### HYGIENE

Maintain general hygiene

#### DEVELOPMENT

Ensure appropriate stimulation therapy

#### EDUCATION

- Explain ward layout & give orientation folder to parents
- Give Bronchiolitis parent/caregiver education leaflet & discuss
- Explain & reinforce treatment, procedures & equipment as required
- Discuss infection control with parents/caregiver

#### DISCHARGE PLANNING

Discuss with parent/caregivers expected plan of care and expected length of stay using the path as a guide

**Reinforce** home management as per Parent handout

#### INTERMEDIATE OUTCOMES

- Respiratory status stable (including slight / nil recession)
- Airway patent
- SaO2 > 93 % in air
- Tolerating fluids
- Voiding
- Patient behaviour assessment indicates patient is comfortable
- Medications given as per Medical orders
- I.V - turn off. Leave bung insitu
- Parents understand treatment plan & expected length of stay
- Parents understand unit layout
- Infection control principles followed by parents/caregivers
- Immunisation status documented on Immunisation Record

#### OUTCOMES

- Contact RMO when all of the following have been achieved to R/V for discharge (at any time):
  - Respiratory status stable in air or usual O2 requirement for > 10 hrs
  - Nil / slight recession
  - SaO2 > 93% in air
  - Feeding well in air
  - RMO contacted & child ready for discharge
  - IV/ bung removed

#### Discharge check list

**MEDICAL & NURSING**

- To be completed only prior to discharge:
  - Parents state they understand home management plan
  - Parents follow up appointment *(if applicable)*
  - Record discharge time on discharge summary
  - RMO details recorded on discharge summary
  - RMO completed discharge letter to GP
SIGN ON REVIEW - CARE TO CONTINUE AS PER PATH
THE SIGNATURES BELOW REFLECT THE CARE GIVEN FOR ‘STAGE B – IN AIR’ DURING EACH SHIFT

<table>
<thead>
<tr>
<th>VARIATION DATE, TIME</th>
<th>Shift: Date:</th>
<th>Yes [ ] No [ ]</th>
<th>Shift: Date:</th>
<th>Yes [ ] No [ ]</th>
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<th>SIGNATURE</th>
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<table>
<thead>
<tr>
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<th>DATE, TIME</th>
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</table>

Refer to Oxygen & IV Guide for Bronchiolitis Path refer to Infection Control Policy
**Variation Report**

**Instructions:** Identify the variation. Complete the plan of care including frequency and expected outcomes. The evaluation should be documented daily or as changes occur in the Patient Record. This is a legal document; please ensure you have signed in the area provided.

**A variation** is defined as any difference between what is recorded on the Clinical Pathway and what actually happens to the patient during their episode of care.

<table>
<thead>
<tr>
<th>Date/Time 24hr</th>
<th>Variation (Eg: what occurred &amp; why)</th>
<th>Plan of Care</th>
<th>Outcomes</th>
<th>Signature / Position</th>
</tr>
</thead>
<tbody>
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</tbody>
</table>
### Instructions:
Identify the special need. Complete the plan of care including frequency /expected outcomes. The **evaluation** should be documented daily or as changes occur in the Patient Record. This is a legal document; please ensure you have signed in the area provided.

A special need is defined as any co-morbidity or condition that the patient has on admission apart from their diagnosis eg. Diabetes.

<table>
<thead>
<tr>
<th>Date/Time 24hr</th>
<th>Special Need</th>
<th>Plan of Care</th>
<th>Outcomes</th>
<th>Signature/Position</th>
</tr>
</thead>
<tbody>
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Dear Doctor,

Admitted on _____/____/20___ at ____:___  Ward:

Registrar:

Discharged on _____/____/___ at ____:___  Consultant:

N.P.A result: Negative ( ) Positive ( )

Virus(es) found: ______________________________________________________________

PRINCIPAL DIAGNOSIS: BRONCHIOLITIS

COMORBIDITIES N / Y _______________________________________________________

COMPLICATIONS N/Y _______________________________________________________

MANAGEMENT OXYGEN N / Y: time in O2______ I.V required: Y / N

This infant (took part/did not take part) in a multicentre study of nebulised adrenaline for bronchiolitis. This study involved the administration of nebulised adrenaline 1:1000 3ml or nebulised saline 3mls, a total of 3 doses administered at 4 hourly intervals. If this infant has any further respiratory distress or problems in the week after discharge, please contact us, telephone 3636 8111.

Please note that immunisations are complete/not complete.

Mother/Father smoke and requests [ ] help/support to quit
[ ] no help/support to quit

A follow up appointment has been arranged for _____/____/___ at __:
not been arranged. [ ]

<table>
<thead>
<tr>
<th>Drug, form and strength (in block letters)</th>
<th>Route</th>
<th>Dose</th>
<th>Frequency</th>
<th>Duration</th>
<th>Quantity dispensed</th>
<th>Pharmacist signature</th>
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Yours sincerely,

__________________________        Pager:
APPENDIX 3: CLINICAL PATHWAY ASSESSMENT

FORM
# Bronchiolitis Pathway Assessment Form

**Hospital:** ………… …… **PATIENT UR:** …………

**Sex** …M…/…F… **D.O.B.** ………../……/…………

<table>
<thead>
<tr>
<th>ADMISSION DATE/TIME</th>
<th>………../……/………..</th>
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<tbody>
<tr>
<td>DISCHARGE DATE/TIME</td>
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Was the Child readmitted within the last 2 weeks of discharge? **YES** / **NO**

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<th>IV FLUIDS</th>
<th>START</th>
<th>FINISH</th>
<th>START</th>
<th>FINISH</th>
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<td>OXYGEN USE</td>
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SaO2 Prior to O2 Administration: **RESPIRATIONS at Admission**

**Drugs used during Admission**

<table>
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<tr>
<th>Drug Name</th>
<th>START</th>
<th>FINISH</th>
<th>Dose (mg)</th>
<th>Route</th>
<th>Frequency</th>
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**RECESSION (at Admission)** **YES** **NO** **UNKNOWN**

**PATHOLOGY** **NPA** **CSS** **OTHER**

**RADIOLOGY** **CXR** **OTHER**

**PATIENT SPECIALED**

**GP LETTER SENT** **YES** **NO** **UNKNOWN**

**MOTHER OR FATHER SMOKE** **YES** **NO** **UNKNOWN**