Home phototherapy for neonatal jaundice – technology and teamwork meeting consumer and service need

Claire Louise Jackson, David Tudehope, Leone Willis, Terri Law, and Jeanne Venz

Claire Louise Jackson is Associate Professor in General Practice & Director, Centre for General Practice & Primary Health Care Integration, Mater Hospitals, Brisbane. Terri Law is Clinical Nurse, Redlands Child, Youth & Family Health, Brisbane. Dr David Tudehope is Director of Neonatology, Mater Mothers Hospital, Brisbane. Jeanne Venz is Clinical Nurse, Coorparoo Child, Youth & Family Health, Coorparoo. Leonie Willis is the Nurse Practice Co-ordinator, Coorparoo Community Health, Coorparoo.

Abstract

32 babies with uncomplicated physiological jaundice received home phototherapy from a hospital / community team in southern Brisbane. All babies showed acceptable reductions in their serum bilirubin on home therapy, and none required hospital re-admission for phototherapy. Their families were highly satisfied with the home program, and recorded high levels of confidence in their therapeutic responsibilities. Community providers were able to deliver a high quality 24-hour service, integrated with appropriate neonatology support. The cost of delivering the home program was significantly less than a comparable hospital stay.

Background

Initiatives this decade to deliver phototherapy for neonatal jaundice via" fibre-optic" or "cold" light, have resulted in a form of phototherapy that is both effective and able to be safely delivered with minimal supervision (see Figure 1). With fibreoptic phototherapy, babies are swaddled in a jacket or "BiliBlanket", which emits fibre-optic light, converting bilirubin to lumirubin by structural isomerization. Babies wear the jacket at all times including feeds (except during bathing). Babies undergoing therapy are no longer at risk of dehydration and optic damage as previously under traditional UV phototherapy, and may receive therapy without intensive therapeutic supervision. Consequently, a number of studies investigating phototherapy services in the home have been undertaken in Europe and the USA (Savinetti *et al* 1990) (Schuman & Karuch 1992).

In 1995, our team was successful in attracting funding to investigate home phototherapy within the Australian health care context. The study sought to evaluate the quality, cost-effectiveness, and family acceptability of a 12-month home phototherapy pilot study for the treatment of uncomplicated neonatal jaundice. The study was designed to extend services in the treatment of physiological neonatal jaundice from a hospital base to that of the community, using existing community providers.

Figure 1

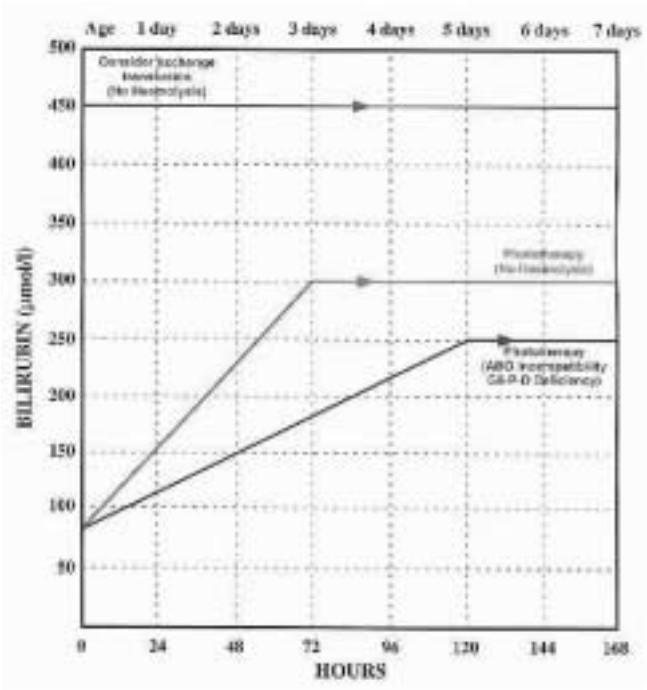
Method

Four nurses from the Coorparoo Child, Youth & Family community nursing unit received five hours in-service hospital training in the safe and effective delivery of phototherapy via the "BiliBlanket". All nurses had previous experience in neonatal paediatrics and midwifery. Two of these nurses then combined to deliver a seven-day service during the life of our study – four hours daily in-home visits, and 20 hours daily on-call via a mobile phone. The other two nurses provided emergency back-up support. Three fibreoptic phototherapy units (BiliBlankets) were purchased and made available for use under the supervision of the community phototherapy nurses, with GP and hospital neonatal support.

Babies were eligible to enter the program if they developed uncomplicated physiological jaundice requiring therapy, and if their parents opted to receive phototherapy via the BiliBlanket in the home, rather than in hospital. All babies delivering at the Mater Misericordiae Mothers Hospital, South Brisbane (over the 12 months of the study) or the Logan Hospital, Logan (over the final 7 months of the study) were eligible if meeting these criteria.

A neonatal registrar or consultant in the Special Care Nursery at the Mater Mothers or Logan Hospitals evaluated babies whose families opted to receive home phototherapy. A full history was taken and physical examination performed to assess general health and possible cause of jaundice. All were fully investigated with serum bilirubins (total & direct), maternal blood grouping, and other tests at the discretion of medical staff. A healthy infant, feeding well without a pathological factor, was eligible for home phototherapy if the serum bilirubin was in the phototherapy range for non-haemolytic jaundice on the treatment nomogram (Fig 2). Parental consent for home phototherapy was a precondition.

Figure 2: Home Phototherapy Management Nomogram for Term Jaundice >2500g



Each day, hospital staff notified the phototherapy nurse of families opting for home phototherapy. She then delivered the BiliBlanket to the infant's home, fully briefed the family concerning its usage, demonstrated and applied the BiliBlanket to the child, and commenced therapy. Each BiliBlanket was fitted with a 24-hour clock documenting the number of hours therapy was administered. This was used to calculate the therapy times for each baby. The treating parent was required to demonstrate successful blanket application prior to the nurse's departure.

The nurse then called daily to perform a well baby assessment and arrange serum bilirubin collection. During the daily visit, she also gauged maternal confidence and attitude, both in general terms and in relation to the home phototherapy program. Once the serum bilirubin result was available each day, she rang the on-call neonatologist to report the level, as well as a review of clinical status of the patient and family. She also contacted the family GP at the commencement of therapy, and on a daily basis during therapy. The nurse reviewed the baby at least once after the cessation of phototherapy. Families were given 24-hour emergency contact numbers for both the phototherapy nurse and registrar in Special Care Nursery.

At the conclusion of therapy, families were asked to return an evaluation questionnaire in a reply-post envelope. The phototherapy nurses were also asked to complete an evaluation on each family.

Analytical method

Times on phototherapy were calculated for each baby and each day of phototherapy and an average was calculated for each day. All times were standardised to 24-hour periods. Total percentages of time on phototherapy were also calculated both individually and averaged across the group. Frequency distributions were tabulated for gestational age, feeding method, age of baby (in hours), cause of jaundice, birthweight and serum bilirubin (SBR) readings at the beginning of phototherapy. The rate of change in weight was calculated by dividing the total change in weight by the number of days on phototherapy. The average was then taken for the group of 32 babies. The mean decrease (and standard deviation) in SBR readings was calculated for each day on phototherapy. Frequency analyses for family and nurse questionnaires were performed using a standard SPSS statistical package.

Results

Biomedical results

32 infants of mean birth weight 3250g, and gestational age range 35–41 weeks, received home phototherapy over 83 days (based on a 24-hour clock). 27 infants were breast-feeding at recruitment. The only other identified causative factor for jaundice was ABO incompatibility in five babies. Phototherapy commenced at mean (SD) age of 109 (38) hours. The mean serum bilirubin (SBR) at commencement was 297 (42) umol / L and at cessation of phototherapy 245 (36). For the subset of 23 babies whose SBRs were performed prior to cessation of phototherapy and again 24 hours later, the SBR decreased from 252 (40) to 244 (34) umol / L. The mean daily decrease in SBR ranged from 10.2 on Day 1, to 30.4 umol /L on Day 4 of phototherapy. The mean duration of phototherapy was 2.6 days, with average therapy times per day of 20.6 hrs (Day 1), 20.4 hrs (Day 2) and 19.4 hrs (Day 3).

Standardised daily phototherapy hours fell below 10 on only four occasions. On two occasions this occurred on Day 1(due to language/cultural issues) and subsequently rose to between 17.1 and 22.9 standardised daily hours after appropriate family discussion / counselling by the phototherapy nurse. A third child had been removed for most of the day for medical and occupational therapy visits. The fourth baby's family moved house on the first day of phototherapy and came from a home environment where the mother spoke no English and the maternal grandmother favoured herbal therapy for the management of jaundice.

Daily phototherapy hours for this baby varied between 13 and 16.2 hours daily. 87.5% of the babies remained breastfed, with all except two babies gaining weight (average gain 26gms / day). The only hospital readmission of a baby on the program was to accompany his mother, who required admission for syncopal episodes.

Questionnaire Results

28 families (87.5 %) completed and returned the parental satisfaction questionnaire following the conclusion of home therapy. All families reported that they were highly satisfied all-necessary information concerning the program had been supplied to them.

27 (96.4%) families reported the phototherapy nurse was "always" responsive to their needs and one (3.6%) "usually responsive". 81.5% reported the phototherapy nurse was always available to them by phone. The remainder (18.5%.) stated that they had not had occasion to call. 85.7% of families reported that phototherapy "always" fitted in with the family routine, 7.1% that it "usually" fitted in with the daily routine and 3.6% that it "occasionally" did so. 92.9% reported that they were "always" confident in their phototherapy responsibilities, with 7.1% "usually" confident.

All of this group preferred the service to in-hospital stay, giving reasons such as "more relaxed, able to be with the family, convenient, feel like a person not a patient, be close to my baby at all times". 17.9% of families had had experience with hospital phototherapy following previous births.

The phototherapy nurses returned a questionnaire on all 32 babies following discharge from the program. In 81% of cases they were "highly satisfied" with the delivery of phototherapy, in 16%"satisfied" and "neutral" in one family.

97% (31/32) of families were reported as "diligent in observation and care". The one family not so recorded had not adequately completed the infant record sheet, and had recorded daily phototherapy times of between 13.1 and 16.2 hours during phototherapy. This family moved to the home of the maternal grandmother after joining the program, and experienced significant pressure to treat the baby with alternate therapy.

The phototherapy nurses received no calls from 56% of the families, one call from 16%, two calls from 22%, and three or more calls from 6%. The majority of calls were related to lactation support rather than the home phototherapy service.

Costs

During the period of the study, the average Mater Mothers Hospital costs for each day of phototherapy was $460 for mother, and $370 for baby. Therefore, potential hospital expenditure incurred for mothers and babies treated in their homes during our pilot (32 mothers and babies treated over 83 days of home care @ $830 / day) amounted to $ 68,890.

Community costs incurred during the study included salary and wages, car lease and petrol, and non-recurrent items (such as the three BiliBlankets required to establish the service). Home phototherapy staffing costs amounted to $31,137 during the 12 months of the study. Car, mileage and fuel payments totalled $10,719. Total recurrent costs for the community delivery of the program amounted to $41,856.

Non-recurring costs for community care included the purchase of the three BiliBlankets and disposables at $10, 203. Salary costs were considerably reduced during the latter half of the study due to re-structure of the weekend staff roster, and vehicle expenses were significantly higher due to a larger client base over a much larger geographical area.

Table 1: Comparison of Costs of Care Delivery

Hospital	Potential costs of hospital accommodation and delivery of care for mothers and babies during 83 days of neonatal phototherapy.	$68,890
Community		
Recurring Costs	Documented community costs in staffing, car lease, mileage an fuel in providing home phototherapy to 32 babies during 83 days of neonatal phototherapy.	$41, 862
Non-recurring Costs	Purchase of 3 BiliBlankets and disposables	$10,203

Discussion

Home phototherapy in this pilot study was highly acceptable to families, cost-effective and safe. Health consumers were capable of effectively accepting increased therapeutic responsibility with appropriate community access and support. Community health professionals were able to be rapidly skilled to effectively deliver additional care close to the client and family.

Our study demonstrates the ability of hospital / community partnerships to deliver high quality health services close to the consumer. The delivery of home phototherapy was shown to be safe. Families were generally diligent with their responsibilities for constant application, with high mean exposure times. The major difficulties encountered lay with cultural / language barriers, which were overcome by ensuring the involvement of family members speaking English, and daily support and encouragement from the community team. Our babies were likely to remain breastfed over the first week of life.

Home phototherapy was shown to be highly acceptable to families. They overwhelmingly supported the availability and responsiveness of the home phototherapy nurse. The study demonstrates (with the improvement in information technology) the potential and willingness of community services to be accessible to clients during extended hours.

The phototherapy nurses were community nurses with paediatric and midwifery experience. Their upskilling with the hospital Special Care Nursery was rapid, and applied easily in their community role. The ensuing partnership between the nursing groups led to the phototherapy nurses returning to the hospital to present updates on the study, and suggestions of future exchanges between the two services.

Whilst a comprehensive economic analysis was outside the brief of this pilot study, baseline data from our hospital and a costing of the pilot's community expenses demonstrate clearly the efficiency of delivering care in this manner. The nursing union with whom we dealt during the design of this study showed themselves to be flexible and motivated to the extension of community care hours, whilst safeguarding member interests.

The major problems faced were those of information dissemination and cultural change across a large tertiary hospital. Accurately informing all the hospital neonatology registrars and nursing staff of the study's methodology and delivery proved a major challenge. In addition, hospital staff expressed reservations concerning the community's ability to deliver appropriate care. This was much more easily overcome in the second hospital included in the latter half of the trial, which recorded an equal family recruitment rate, despite having a fifth of the number of deliveries. This hospital had a much smaller number of involved staff, existing networking, and was used to sharing care with the community. Larger hospitals may require significant information dissemination and staff development support when instituting new care programs linking the community.

The success of this pilot study has allowed an expansion of home phototherapy to all women delivering babies with uncomplicated neonatal jaundice at the Mater Mothers Hospital. This service is delivered as part of the Home Care Program, and means that the majority of jaundiced infants can be discharged home with their mothers. Over the past 11 months, 66 infants have participated in the expanded home phototherapy scheme, allowing infants and their families to receive appropriate care in the familiarity of their own homes, and health professionals to benefit from better integrated and focussed care.

References

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