Commonwealth of Massachusetts
Center for Health Information & Analysis (CHIA)
Non-Governmental Application for Case Mix Data

This form is to be used by all applicants, except Government Agencies, as defined in 957 CMR 5.02.

***NOTE:** In order for your application to be processed, you must submit the required application fee. Please consult the fee schedule for the appropriate fee amount. A remittance form with instructions for submitting the application fee is available on the CHIA website.*

I. GENERAL INFORMATION

APPLICANT INFORMATION	
Applicant Name:	David Goodman, MD, MS
Title:	Professor of Pediatrics and of Health Policy
Organization:	The Dartmouth Institute for Health Policy & Clinical Practice
Project Title:	The Epidemiology and Efficiency of Neonatal Intensive Care
Mailing Address:	5th Floor, Williamson Translational Research Building 1 Medical Center Drive Lebanon, NH 03756
Telephone Number:	(603) 653-0815
Email Address:	David.C.Goodman@dartmouth.edu
Names of Co-Investigators:	N/A
Email Addresses of Co-Investigators:	N/A
Original Data Request Submission Date:	January 27, 2015
Dates Data Request Revised:	
Project Objectives (240 character limit)	Conduct the first population-based study of newborn and neonatal intensive care for the total live birth cohorts of four states (ME, VT, NH, MA) and for Blue Cross Blue Shield (BCBS) insured newborns in Texas (N= ~134,000 per year x 4 yrs. or ~536,000 newborns).
Project Research Questions (if applicable)	1. Which newborns are admitted to neonatal intensive care units (NICUs) today, and at what level of care? 2. What are their problems, and how much do the admission patterns vary across health systems? 3. Do the benefits always outweigh risks of intensive care when newborns are not critically ill? 4. What are the costs of NICU care for different types of patients, and is better care always more expensive?

II. PROJECT SUMMARY

Briefly describe the purpose of your project and how you will use the requested CHIA data to accomplish your purpose.

Neonatal intensive care has been highly successful at reducing newborn mortality and morbidity, but the quality of care, outcomes, and efficiency has been poorly documented and is poorly understood. In particular, improving the *value* of care has been elusive, in the absence of outcomes-adjusted efficiency measures of specific neonatal intensive care units (NICUs). A significant gap in medical and healthcare-related literature can be found regarding patterns of care for newborns utilizing neonatal intensive care units (NICUs). The studies that have been published to date either have small sample sizes, do not measure newborns admitted to Level II nurseries, examine non-US births, exclude those babies over 35-40 weeks or less than 37 weeks gestation, or are from data 20 years old.

This project will provide both a more up-to-date picture of the care received by all newborns while being able to answer important questions as to the value of such care. The proposed analyses of this project will examine the overall and regional variation in newborn care, focusing on the illness-adjusted (e.g. birth weight and other perinatal risk factors and diagnoses) use of intensive care (i.e. defined as Levels II, III, IV care) by different newborn conditions and associated utilization and health outcomes. Patient and provider factors associated with the variation in NICU use will also be studied to reveal potential opportunities for improvement in care. The spefic aims are to:

- Measure the probability of NICU admissions by newborn characteristics (e.g. birthweight) across states and neonatal intensice care regions;
- Measure the association of risk adjusted NICU admisssions with provider/community characteristics, including measures of capacity (i.e. NICU beds and neonatologists); and for those newborns admitted to NICUs;
- Measure regional and hospital variation in risk adjusted utilization of NICU services (e.g. length of stay, level of care, imaging, allowed charges) and outcomes, including: inpatient mortality, readmissions, and ER and their association with provider/community characteristics.

First, this project will define market areas fo neonatal intensive care services (Neonatal Intensive Care Regions, NICR) using claims data and established methods in small-area analysis. This involves attributing populations to NICRs based on ZIP code of maternal residence and actual patterns of care (ZIP codes of hospitals). Using these service areas as the unit of analysis, it will then perform a number of descriptive analyses to characterize the use of such services. Finally, it will look to test certain hypotheses as to the relationship between NICU capacity and utilization, as well as downstream effects on patient outcomes, health care utilization and costs.

Although the project has received the APCD and Medicaid claims from MA, we have learned that that CHIA dataset is the most reliable source of all hospitalized newborns in MA. The requested CHIA Level VI inpatient discharge data will be used to identify live birth newborns by diagnosis codes and measure hospital events including admissions into neonatal intensive care units.

III. FILES REQUESTED

Please indicate the databases from which you seek data, and the Level(s) and year(s) of data requested.

CASE MIX	Levels 1 – 6	Fiscal Years Requested
Inpatient Discharge	☐Level 1 – No Identifiable Data Elements ☐Level 2 – Unique Physician Number (UPN) ☐Level 3 – Unique Health Information Number (UHIN) ☐Level 4 – UHIN and UPN	1998 – 2014 Available (limited data 1989-1997)

	☒Level 5 – Date(s) of Admission; Discharge; Significant Procedures ☐Level 6 – Date of Birth; Medical Record Number; Billing Number **PLEASE PROVIDE JUSTIFICATION BELOW FOR REQUESTING THE CHOSEN LEVEL:** It is essential that we receive Level 5 data elements in order to achieve our project's aims and objectives. Level 5 data contains dates of admission and dates of discharge. This information is necessary in to confirm that a newborn was born in a hospital on a given day of admission. We are also aware that Level 5 data contains newborn encrypted social security numbers, the mother's encrypted social security in the newborns records, as well as a separate date field is provided for all 15 procedure codes. It is imperative that we receive Level 5 data elements because we believe that there are some quality issues regarding dates of admission and discharge within the Medicaid data. Given that the Level 5 data elements provide encrypted SSNs, newborn procedures dates, and information pertaining to the mother's obstetric procedure, we can use this Level 5 data as a secondary source to verifiy a newborn's admission to a hospital.	1998-2014 Available **Requesting October 1, 2008 through December 31, 2013**
Outpatient Observation	☐Level 1 – No Identifiable Data Elements ☐Level 2 – Unique Physician Number (UPN) ☐Level 3 – Unique Health Information Number (UHIN) ☐Level 4 – UHIN and UPN ☐Level 5 – Date(s) of Admission; Discharge; Significant Procedures ☐Level 6 – Date of Birth; Medical Record Number; Billing Number **PLEASE PROVIDE JUSTIFICATION BELOW FOR REQUESTING THE CHOSEN LEVEL:** N/A	2002 – 2014 Available
Emergency Department	☐Level 1 – No Identifiable Data Elements ☐Level 2 – Unique Physician Number (UPN) ☐Level 3 – Unique Health Information Number (UHIN) ☐Level 4 – UHIN and UPN ☐Level 5 – Date(s) of Admission; Discharge; Significant Procedures ☐Level 6 – Date of Birth; Medical Record Number; Billing Number **PLEASE PROVIDE JUSTIFICATION BELOW FOR REQUESTING THE CHOSEN LEVEL:** N/A	2000 – 2014 Available

IV. FEE INFORMATION

Please consult the fee schedules for Case Mix data, available at http://chiamass.gov/regulations/#957_5, and select from the following options:

☒ Single Use
☐ Limited Multiple Use
☐ Multiple Use

Are you requesting a fee waiver?
☐ Yes
☒ No

If yes, please submit a letter stating the basis for your request. Please refer to the fee schedule for qualifications for receiving a fee waiver. If you are requesting a waiver based on the financial hardship provision, please provide documentation of your financial situation. Please note that non-profit status alone isn't sufficient to qualify for a fee waiver.

V. REQUESTS PURSUANT TO 957 CMR 5.04 (Researchers, Payers, Providers, and Provider Organizations)
Please complete only if you are requesting Level 1 (de-identified) Case Mix.

Please describe how you will use such data for the purposes of lowering total medical expenses, coordinating care, benchmarking, quality analysis or other administrative research purposes.

N/A

VI. ALL OTHER REQUESTS - PURPOSE AND INTENDED USE

1. Please explain why completing your project is in the public interest.

Neonatal intensive care has been highly successful in reducing death and illness in newborns, particularly in those who are very premature. However, quality of care, outcomes and efficiency have been poorly documented and are poorly understood. In particular, improving the *value* of care has been elusive, in the absence of outcomes-adjusted efficiency measures of specific neonatal intensive care units (NICUs). Parents today are faced with real, but invisible variation in the life chances of their newborns while payers (e.g. insurance plans, employers, states and CMS, parents) are exposed to differences in costs that may be poorly linked to quality.

Despite the importance of newborn special care, there have been very few published research studies that have examined the quality and efficiency of care, and almost none at the level of regions or providers. There are no studies of the epidemiology of NICU and newborn care using the entire live birth cohort as the population at-risk (i.e. the full range of newborns and newborn illness). Only through studying all live births, can one observe trends in patterns of NICU care over time and the variation in quality and costs for both premature and full term neonates.

Findings from this study will provide a rich description of the use of newborn services across regional health care systems. The risk-adjustment model developed for this study will lead to studies of factors associated with variation in

utilization and outcomes – simply, whether utilization is related to outcomes. It is the goal of this project to stimulate clinical practice improvement and policy development to improve newborn care, reduce mortality and morbidity, and to moderate costs through avoidance of unnecessary or low value care. The study of practice variation in non-NICU care has an excellent track record of achieving these aims and continues to be a productive method of stimulating inquiry into care patterns that leads to patient benefits at lower costs.

Five main types of information will be generated from this research and serve to act in the public's interest:

1. Study findings will provide information about the delivery of newborn care, particularly neonatal intensive care, for a population primarily cared for by a single or limited set of providers within the study regions. That is, properly defined small areas (although the actual size depends on the local or regional nature of the medical services) are geographic representations of health care markets where the newborn patterns of care principally reflect the practice styles of within area hospitals and doctors. When the measurement is at hospital level, such as birth weight adjusted length of NICU stays, then the attribution of a population of newborns to a responsible provider (i.e. the hospital) is highly specific. Specificity of attribution helps identify the accountable health system, the locus for possible improvement.

2. Study findings will raise important questions about the reasonableness of current patterns of practice and this, in turn, stimulates both provider engagement and professional self-examination.

3. Study findings will show what is attainable, by accident or design, in quality and efficiency, and can offer benchmarks that guide clinical improvement and public policies.

4. Study findings will generate hypotheses regarding the causes of variation, and the data can be used to test these hypotheses.

5. Study findings can be used to develop public reporting of performance measures, and these are known to accelerate the pace of change.

2. **Attach** a brief (1-2 pages) description of your research methodology. (This description will not be posted on the internet.)

   SEE ATTACHED DOCUMENT TO THIS APPLICATION.

3. Has your project received approval from your organization's Institutional Review Board (IRB)? Please note that CHIA will not review your application until IRB documentation has been received (if applicable).
   - ☒ Yes, and a copy of the approval letter is attached to this application.
   - ☐ No, the IRB will review the project on _____.
   - ☐ No, this project is not subject to IRB review.
   - ☐ No, my organization does not have an IRB.

VII. APPLICANT QUALIFICATIONS

1. Describe your qualifications to perform the research described or accomplish the intended use of CHIA data.

Primary Investigator

The primary investigator, David C. Goodman, is Professor of Pediatrics and of Health Policy at The Dartmouth Institute

for Health Policy & Clinical Practice, as well as is the Co-Principal Investigator of the *Dartmouth Atlas of Health Care*. Additionally, Dr. Goodman is an Adjunct Professor at the Institute for Social and Preventive Medicine at the University of Bern. His primary research interest is in geographic and hospital variation in health system performance. Over the past two decades, he has studied the causes and consequences of medical variation in diverse clinical and policy areas including neonatal intensive care, pediatric medical care, primary care, family planning services, and the Medicare population.

Dr. Goodman is a founding member of the Wennberg International Collaborative – an international research network committed to improving healthcare by examining organizational and regional variation in health care resources, utilization, and outcomes. He is also one of the founding investigators of the *Dartmouth Atlas of Health Care* and has led multiple Atlas projects on such topics as end-of-life cancer care, post hospital discharge care, and care for infants and children. Dr. Goodman has developed and taught Dartmouth graduate courses on advanced health services research methods, unwarranted variation in health care, and comparative health systems. He has served on multiple journal editorial boards, and federal and Institute of Medicine committees. His research papers and editorials have been published in the *New England Journal of Medicine, JAMA, Health Affairs, Pediatrics,* and *The New York Times*.

The Dartmouth Institute for Health Policy & Clinical Practice

The Dartmouth Institute comprises a cross-departmental group of faculty and associated staff who conduct research on medical care and its improvement. More than fifty core faculty of The Dartmouth Institute include representation from many clinical and social science disciplines with particular expertise in (1) the use of administrative databases for measuring medical care, (2) health policy, (3) comparative effectiveness research, (4) technology assessment, (5) decision analysis, (6) health systems improvement and (7) patient preferences research.

Through Dartmouth's Clinical and Translational Science Institute, SYNERGY, The Dartmouth Institute has established a Center for Translational Population Research, which provides resources assessing the population impact of innovations in health care delivery and health care payment reform on population health and costs of care through studies involving administrative data enriched with clinical and patient-reported outcomes data.

Computational environment

The Dartmouth Institute for Health Policy & Clinical Practice provides 7-day, 24-hour access to its seven interconnected Dell PowerEdge servers, running Red Hat Enterprise Linux. Each server contains four hexacore processors and 256 GB of RAM and is connected via a 10 GbE network switch to a scalable network-attached storage (NAS) appliance with a capacity of over 250 TB enabling off-site backup to disk and full hot swap capability for both the source and backup appliances. All connections to this server are secured by Secure Shell (SSH), which encrypts all communications to and from the workstations on an isolated firewalled network. Major applications software includes SAS and STATA. Authorized users may access the system only via Virtual Private Network (VPN), or locally through the firewalled intranet, using Red Hat Linux workstations and SSH.

The Data and Analytic Core (DAC) production computing environment is located in Dartmouth College's state of the art data center featuring:

- FISMA compliant
- 2,110 square foot facility with raised floor for power and network
- 45 rack capacity
- Caterpillar 3512C 1500 KW Backup Power Generator
- (x2) 500kVA UPS, current draw is ~58kVA, so about 12% utilization
- (x5) Air handlers in current use, N+1

- Multi-level Lenel-based access system including access cards, keypads, and video monitoring
- FM-200 waterless fire suppression system

All DAC servers, data storage, switches, and other peripherals are stored in isolated rack cages with DAC-dedicated key locks limiting access to the DAC Network Systems Administrator. All data traffic for the project is contained within a private network (VLAN) that is only present on the switches that connect to the actual end points, and the backbone in between. The only routed entry point for the network is The Dartmouth Institute's firewall; no other network can route traffic into the VLAN without passing through The Dartmouth Institute's firewall. All switches that carry the VLAN are hardened against attacks that would allow attackers to gain access to the VLAN. The VLAN is private in that it only contains hosts that are part of the DAC.

Analytic capability

The Data and Analytic Core supports the analytic needs of projects using large administrative datasets, including claims files, for investigators across the Geisel School of Medicine at Dartmouth and Dartmouth College. The Dartmouth Institute is the largest university-based repository of Medicare data in the world and has been working with these data to produce the Dartmouth Atlas and related research for 30 years. The DAC consists of 12 analysts, as well as 5 administrative and operational staff, with a combined experience-base of more than 150 years of healthcare claims analytic experience and a mastery of a broad range of programming and statistical methods. New analysts undergo a comprehensive training program to assure a strong foundation in Medicare data analytics.

The Dartmouth Institute also supports a joint spatial-epidemiology analytic core with the Norris Cotton Cancer Center that includes geo-spatial analysts and high-speed servers optimized to demanding GIS tasks coupled with licenses for ArcGIS, MapInfo, and other GIS software. The Core also has high-speed color laser printers and large format plotters suitable for printing 42 inch high x unlimited length color maps.

2. Attach résumés or curricula vitae of the applicant/principal investigator, key contributors, and of all individuals who will have access to the data. (These attachments will not be posted on the internet.)

   SEE ATTACHED DOCUMENTS TO THIS APPLICATION.

VIII. DATA LINKAGE AND FURTHER DATA ABSTRACTION

Note: Data linkage involves combining CHIA data with other databases to create one extensive database for analysis. Data linkage is typically used to link multiple events or characteristics that refer to a single person in CHIA data within one database.

1. Do you intend to link or merge CHIA Data to other datasets?
   - ☐ Yes
   - ☒ No linkage or merger with any other database will occur

2. If yes, will the CHIA Data be linked or merged to other individual patient level data (e.g. disease registries, death data), individual provider level data (e.g., American Medical Association Physician Masterfile) , facility level (e.g., American Hospital Association data) or with aggregate data (e.g., Census data)? [check all that apply]

   ☐ Individual Patient Level Data

   What is the purpose of the linkage:

N/A

What databases are involved, who owns the data and which specific data elements will be used for linkage:

N/A

☐ Individual Provider Level Data

What is the purpose of the linkage:

N/A

What databases are involved, who owns the data and which specific data elements will be used for linkage:

N/A

☐ Individual Facility Level Data

What is the purpose of the linkage:

N/A

What databases are involved, who owns the data and which specific data elements will be used for linkage:

N/A

☐ Aggregate Data

What is the purpose of the linkage:

N/A

What databases are involved, who owns the data and which specific data elements will be used for linkage:

N/A

3. If yes, for each proposed linkage above, please describe your method or selected algorithm (e.g., deterministic or probabilistic) for linking each dataset. If you intend to develop a unique algorithm, please describe how that algorithm will link each dataset.

N/A

4. If yes, please identify the specific steps you will take to prevent the identification of individual patients in the linked dataset.

N/A

5. If yes, and the data mentioned above is not in the public domain, please attach a letter of agreement or other appropriate documentation on restrictions of use from the data owner corroborating that they agree to have you initiate linkage of their data with CHIA data and include the data owner's website.

IX. PUBLICATION / DISSEMINATION / RE-RELEASE

1. Describe your plans to publish or otherwise disclose CHIA Data, or any data derived or extracted from such data, in any paper, report, website, statistical tabulation, seminar, conference, or other setting.

The immediate outcomes of this project will be peer-reviewed journal papers. There are no plans to engage in public reporting of specific providers/hospital systems based on CIA data or our analysis.

2. Will the results of your analysis be publicly available to any interested party? Please describe how an interested party will obtain your analysis and, if applicable, the amount of the fee.

Results will be made available to the public through journal article publications. The Dartmouth Institute will not charge any fee for accessing these results and the papers will be available to all subscribers with access to these academic journals. Upon request, the Dartmouth Institute will provide copies of the articles free of charge.

3. Will you use the data for consulting purposes?

☐ Yes
☒ No

4. Will you be selling standard report products using the data?

☐ Yes
☒ No

5. Will you be selling a software product using the data?

☐ Yes
☒ No

6. Will you be reselling the data?

☐ Yes
☒ No

If yes, in what format will you be reselling the data (e.g., as a standalone product, incorporated with a software product, with a subscription, etc.)?

N/A

7. If you have answered "yes" to questions 3, 4 or 5, please describe the types of products, services or studies.

N/A

X. USE OF AGENTS AND/OR CONTRACTORS

Third-Party Vendors. Provide the following information for all agents and contractors who will work with the CHIA Data.

Company Name:	N/A
Contact Person:	
Title:	
Address:	
Telephone Number:	
E-mail Address:	
Organization Website:	

8. Will the agent/contractor have access to the data at a location other than your location, your off-site server and/or your database?

☐ Yes
☒ No

If yes, please provide information about the agent/contractor's data management practices, policies and procedures in your Data Management Plan.

9. Describe the tasks and products assigned to this agent or contractor for this project.

N/A

10. Describe the qualifications of this agent or contractor to perform such tasks or deliver such products.

N/A

11. Describe your oversight and monitoring of the activity and actions of this agent or subcontractor.

N/A

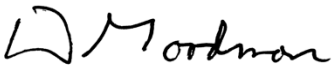
XIII. ASSURANCES

Applicants requesting and receiving data from CHIA pursuant to 957 CMR 5.00 ("Data Recipients") will be provided with data following the execution of a data use agreement that requires the Data Recipient to adhere to processes and procedures aimed at preventing unauthorized access, disclosure or use of data.

Data Recipients are further subject to the requirements and restrictions contained in applicable state and federal laws protecting privacy and data security, and will be required to adopt and implement policies and practices to protect CHIA data in a manner consistent with the requirements of the federal Health Insurance Portability and Accountability Act of 1996 (HIPAA).

Data Recipients must promptly notify CHIA of any unauthorized use or disclosure of CHIA data.

By my signature below, I attest to: (1) the accuracy of the information provided herein; (2) my organization's ability to meet CHIA's minimum data security requirements; and (3) my authority to bind the organization seeking CHIA data for the purposes described herein.

Signature:	
Printed Name:	David C. Goodman, MD MS
Original Application Submission Date:	1/20/16
Dates Application Revised:	