RESEARCH LETTER

The Spectrum of Community-Based Hospitalist Practice: A Call to Tailor Internal Medicine Residency Training

The field of hospital medicine is growing rapidly, with a projected workforce approaching 30 000.[1-3] While approximately 85% of hospitalists are internal medicine (IM) trained,[4] very few IM residency training programs offer focused training in hospital medicine. Plauth and colleagues[1] have described a training mismatch for IM-trained hospitalists in geriatrics, palliative care, neurology, and perioperative and consultative medicine. Arora et al[5] suggest that a "training practice gap" may exist in hospital medicine and called for training to more accurately reflect the clinical practice of hospital medicine. To address the magnitude of this gap, we assessed the spectrum of diagnoses encountered and the manner of involvement of hospitalists practicing in a large community-based hospitalist group.

We reviewed the billing database of IPC–The Hospitalist Company, North Hollywood, Calif, from August 1, 2003, to July 31, 2004, for primary *International Classification of Diseases, Ninth Revision* (*ICD-9*) codes and whether the hospitalist was the attending physician or a consultant. This community-based hospitalist practice is the sum of many individual, local hospitalist groups, totaling 436 hospitalists at 133 hospitals in 11 major US cities. To limit the effect of infrequent diagnoses, we excluded those diagnoses that occurred less frequently than 0.1% of the time. Individual diagnoses were categorized by *ICD-9* organ systems. *International Classification of Diseases, Ninth Revision* codes 780.1 through 799.9 describe "symptoms, signs, and ill-defined conditions." For these we assigned the most referable organ system based on group discussion. Three codes (bowel obstruction [560.9], cholecystitis [575], and appendicitis [541]) were classified as general surgical diagnoses.

A total of 141 354 patients classified with 2185 individual *ICD-9* codes were admitted to the hospitalist services during the study period. Of these, 177 codes were used in at least 0.1% of all cases, and the less frequent codes (n = 2008) led to the exclusion of 32 443 patients, leaving 108 911 patients in the primary diagnosis analysis. Of the 108 911 patients, 32 255 (29.6%) (representing 39 different *ICD-9* codes) had a primary *ICD-9* code from the category "symptoms, signs, and ill-defined conditions."

Table 1 depicts the most common primary diagnoses and the type of hospitalist involvement. **Table 2** outlines the frequency of diagnoses by organ system. General surgical diagnoses accounted for 2.2% of all primary diagnoses, and hospitalists acted as the primary attending physician in 91% of these cases. Of the patients, 45.9% were older than 65 years, and patients aged 75 to

Table 1. Most Common Primary Diagnoses and the Status of the Involved Hospitalist

Diagnosis	*ICD-9* Code	Total Cases, No.	Total Cases, %	Hospitalist: Primary Attending Physician, %	Hospitalist: Consultant, %
Chest pain	786.50	8186	7.52	98	2
Pneumonia	486	4430	4.07	98	2
Syncopal episode	780.2	3896	3.58	98	2
CHF exacerbation	428.0	3836	3.52	97	3
Abdominal pain	789.00	3627	3.33	96	4
GI tract bleed	578.9	3554	3.26	99	1
Cellulitis	682.9	3010	2.76	97	3
COPD exacerbation	491.21	2940	2.70	98	2
Stroke, acute	436	2833	2.60	96	4
Pancreatitis, acute	577.0	2281	2.09	98	2
Sepsis	038.9	1616	1.48	96	4
Seizure	780.39	1549	1.42	98	2
TIA	435.9	1494	1.37	99	1
Chest discomfort	756.59	1485	1.36	96	4
Hip fracture	820.8	1446	1.33	78	22
Other diagnoses		62 728	57.61	92	8
Total		**108 911**	**100**	94	6

Abbreviations: CHF, congestive heart failure; COPD, chronic obstructive pulmonary disorder; GI, gastrointestinal; *ICD-9*, *International Classification of Diseases, Ninth Revision*; TIA, transient ischemic attack.

Table 2. Number and Frequency of Primary Diagnosis by Organ System

Diagnostic Type and Organ System	No. of Patients	Frequency of Diagnosis, %
Medical diagnoses		
Cardiovascular	26 886	24.7
Gastrointestinal	17 313	15.9
Pulmonary	16 479	15.1
Genitourinary	5008	4.6
Other	19 236	17.7
Medical subtotal	84 922	78.0
Nonmedical diagnoses		
Neurology	14 558	13.4
Orthopedic	6999	6.4
General surgical	2432	2.2
Nonmedical subtotal	23 989	22.0
Total	**108 911**	**100**

84 years constituted the single largest subgroup (18.8%). Hospitalists acted as consultants in 6.4% of the cases.

Our findings show that nearly 30% of a community hospitalist's practice consists of areas that may be underemphasized in traditional IM residency training (consultation, 6.4%; or diagnoses such as neurologic, 13.4%; orthopedics, 6.4%; and general surgery, 2.2%). Hospitalists also provided a significant amount of perioperative and geriatric medical care. Data from academic hospitalist groups, which likely reflect the exposure of many IM-trained residents, show a much different case mix, with only occasional neurologic diagnoses and no orthopedic problems.[6-12] Only 1 of the programs with a neurologic diagnosis was centered at a university hospital,[11] and the program managing the highest proportion of neurologic cases was at a community teaching hospital.[12] In comparison, neurologic and orthopedic diagnoses made up 5 of the top 15 diagnoses in our data set. In addition, diagnoses such as human immunodeficiency virus, systemic lupus erythematosus, and sickle cell disease, which were represented in some of the academic settings, did not appear on our list.

To date, this is the largest evaluation, to our knowledge, of the practice case mix seen in a community hospitalist practice. Prior studies are smaller, mostly from single academic centers, and have not differentiated the consultant from the attending physician role.[6-22] Community hospitalists are providing a substantial amount of geriatric care and have a large role as consultants in perioperative care and as attending physicians in "nonmedical" disease states, such as stroke, hip fracture, and cholecystitis. Most of these areas are not strongly emphasized in traditional IM training programs.

This study has several limitations. There may be inaccuracies in the database, misclassifications in the symptom-based *ICD-9* codes, and double counting of consultative work depending on the location of care (eg, orthopedic ward vs a medical ward). We may also have undercounted the amount of neurologic, orthopedic, and general surgical diagnoses because they may often have been billed as a secondary diagnosis.

The rapid growth of hospital medicine has largely been fueled by perceived improvements in hospital efficiency, reductions in cost of care, and quality improvement. In many cases, this includes involvement in areas for which IM-trained hospitalists have little training, namely neurologic, orthopedic, geriatric, perioperative, and consultative medicine. As more IM residents go into hospital medicine practices, our findings may be useful to IM residency programs as they modify training experiences to provide the skill set necessary to effectively practice as a community-based hospitalist.

Jeffrey J. Glasheen, MD
Kenneth Richard Epstein, MD
Eric Siegal, MD
Jean S. Kutner, MD
Allan V. Prochazka, MD, MSc

Correspondence: Dr Glasheen, Department of Medicine, University of Colorado at Denver and Health Sciences Center, University of Colorado Hospital, 4200 E Ninth Ave, Box F782, Denver, CO 80262 (jeffrey.glasheen@uchsc.edu).

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COMMENTS & OPINIONS

Vitamin B_{12} Deficiency in Patients Receiving Metformin: Clinical Data

We read with interest the excellent article by Ting and colleagues[1] about risk factors of vitamin B_{12} deficiency in patients receiving metformin. We would like to offer some findings from our own experience. To date, more than 30 patients with metformin-associated vitamin B_{12} deficiency have been registered in a cohort study of cobalamin deficiency in the University Hospital of Strasbourg, Strasbourg, France (partial data were previously published[2]). An analysis of these patients (median age, 66 years) proves some of the comments by Ting et al.[1] First, the clinical severity of metformin-associated vitamin B_{12} deficiency is moderate, with 90% of minor hematological abnormalities (median hemoglobin levels and mean erythrocyte cell volume, 11.5 g/dL and 95.4 fL, respectively) and 30% of mild peripheral sensitive neuropathy. However, there were 2 cases (5.7%) of symptomatic anemia and pancytopenia (requiring transfusions). The mean ± SD serum vitamin B_{12} and total homocysteine levels were 156 ± 31 pg/mL (range, 87-200 pg/mL) (115.1 ± 22.9 pmol/L [range, 64-148 pmol/L) and 2.0 ± 0.8 mg/L (range, 2-3 mg/L) (14.8 ± 5.7 μmol/L [range, 13-22 μmol/L]). Second, an analysis of our cases suggests that the principal mechanism of vitamin B_{12} deficiency in patients receiving metformin is undoubtedly food-cobalamin malabsorption. In fact, of 34 patients' responses to the diagnostic criteria we had previously published,[3] 1 patient had a malabsorption with chronic diarrhea.[2] In our opinion, this mechanism of food-cobalamin malabsorption may explain the constant efficacy of oral crystalline cyanocobalamin therapy that we have observed as a benefit of calcium supplementation. To our knowledge, discontinuation of metformin therapy remains controversial, but our results suggest that it may be unnecessary.

Emmanuel Andrès, MD
Laure Federici, MD

Correspondence: Dr Andrès, Service de Médecine Interne, Diabete et Maladies Métaboliques, Clinique Médicale B, 1 place de l'Hôpital, 67 091 Strasbourg CEDEX, France (emmanuel.andres@chru-strasbourg.fr).

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The Long and Short of Metformin-Related Vitamin B_{12} Deficiency

We applaud Ting et al[1] for their study demonstrating the risk of vitamin B_{12} deficiency with increasing dose and duration of metformin use. In contrast to previous reports, their study demonstrated no excess risk of vitamin B_{12} deficiency among metformin users who currently use histamine$_2$-receptor blockers or proton pump inhibitors.[1] This statement should be interpreted very cautiously, although the authors allude to the fact that the lack of association in their study may stem from imprecise hospital-based medication records and inability to track the use of histamine$_2$-receptor blockers or proton pump inhibitors. Gastrointestinal symptoms can be a limiting factor in optimizing metformin therapy, and metformin has been recognized *not* to alter intestinal motility or bacterial overgrowth.[1,2] Interestingly, almost one half of adult consumers of over-the-counter histamine$_2$-receptor blockers have been reportedly using these drugs in a manner inconsistent with Food and Drug Administration labeling, and this off-label use was associated with substitution for physician care.[3] This has indeed clearly demonstrated that the over-the-counter use of such drugs are rampant, hence contributing to the reasons for the spectacular and rapid decline in antireflux surgery.[4] Histamine$_2$-receptor blockers or proton pump inhibitors impair the absorption of protein-bound dietary vitamin B_{12} and contribute to the development of B_{12} deficiency with prolonged use.[5] The inhibition of acid secretion by the gastric parietal cells results in decreased gastric acid and pepsin secretion required for the cleavage of dietary B_{12}.[5] As an illustrative example, some of the reports cited from the literature do not even take into account the plausible role of histamine$_2$-receptor blockers or proton pump inhibitors, and to our knowledge, a therapeutic trial of metformin therapy has never been attempted to identify whether metformin was genuinely the cause of vitamin B_{12} deficiency.[5] This has particular inference, especially when the study by Ting et al[1] has not been able to identify the exact mechanism of metformin-related vitamin B_{12} deficiency but only supports the notion of a causal relationship.[5]

George I. Varughese, MRCPI, MRCP(UK)
Abd A. Tahrani, MD, MRCP
John H. B. Scarpello, MD, FRCP

Correspondence: Dr Varughese, Specialist Registrar in Diabetes, c/o ward 61–the Metabolic Unit, University Hos-