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Medical Spending Differences in the U.S. and Canada:

The Role of Prices, Procedures, and Administrative Expense

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ABSTRACT

The U.S. far outspends Canada on health care, but the sources of additional spending are unclear. We evaluated the importance of incomes, administration, and medical interventions in this difference. Pooling various sources, we calculated medical personnel incomes, administrative expenses, and procedure volume and intensity for the U.S. and Canada. We found that Canada spent $1589 per capita less on physicians and hospitals in 2002. Administration accounts for the largest share of this difference (38 percent), followed by incomes (31 percent), and more intensive provision of medical services (14 percent). Whether this additional spending is wasteful or warranted is unknown.

BACKGROUND

The United States spends nearly twice as much per capita on health care as Canada: $7,290 per person in the U.S. in 2007 compared with $3895 in Canada (OECD 2009a). This difference constitutes 19 percent of median household income for a household of four, $72,695 (American Community Survey 2007). Sixty-six percent of this difference in spending is for hospitals and physicians. The rest is accounted for by government activities (10%); other professional services (9%); other institutions such as nursing homes (7%); prescription drugs (5%); and capital investment and other spending (4%). (Centers for Medicare and Medicaid Services (CMS) 2009; Canadian Institute for Health Information (CIHI) 2008). Despite this higher spending, however, the U.S.'s health indicators continue to lag behind those of Canada. In 2006, infant mortality was 6.7 per 1,000 live births in the U.S., compared to 5.0 in Canada. In the same year, life expectancy at birth was 78.1 in the U.S. and 80.7 in Canada (OECD 2009a).

Some of U.S. health care spending is valuable. The U.S. has received a high return on investment to care for depression, heart attacks, and low birth weight infants (Cutler 2005). At the same time, there is evidence of wasteful spending as well. For example, a cross-national survey of health systems found that 14 percent of Americans reported that a physician had ordered a test that had already been done, compared to 5 percent in Canada (Schoen, Osborn, Bishop, et al. 2007).

While we can see from national health accounts which sectors of the U.S. health care system exhibit higher spending than in Canada, it is unclear where this additional spending is coming from. Determining the sources of additional spending is the first step in determining whether such spending is wasteful. Previous studies have examined

various reasons for greater U.S. health care spending. Some studies stress administrative expenses; estimates suggest that U.S. administrative costs are 46 to 71 percent higher than Canada (Aaron 2003; Woolhandler, Campbell, and Himmelstein 2003). Other studies propose that higher prices paid for services are the primary driver of greater spending (Anderson, Reinhardt, Hussey, et al. 2003). Pharmaceutical costs are higher for branded drugs (Danzon 1992; Graham and Robson 2000), and physicians earn more in the U.S. as well (Newhouse 1992). Still other studies have examined the volume of health care services received. These studies usually focus on one condition or procedure, such as myocardial infarction (Mark, Naylor, Hlatky, et al. 1994; Rouleau, Moyé, Pfeffer, et al. 1993; Tu, Pashos, Naylor, et al. 1997), coronary artery bypass graft surgery (Eisenberg, Filion, Azoulay, et al. 2005; Anderson, Grumbach, Luft, et al. 1993), or hip replacement surgery (Antoniou, Martineau, Filion, et al. 2004). In virtually all of these settings, the U.S. has been found to treat patients more aggressively than Canada.

While all of these hypotheses have support in the data, analyses have focused on only one explanation at a time. Thus, the relative importance of each factor in accounting for the large difference in health care spending between the U.S. and Canada is not known. In this study, we considered three of the most salient arguments for why the U.S. spends more on health care—higher administrative costs, greater incomes for health care workers, and larger volume and intensity of medical interventions. We determined how much each explanation contributed to differences in spending between the U.S. and Canada. Because hospital and physician services constitute the bulk of spending differences, we focused on these two areas.

METHODS

General Approach

We explored three facets of spending: medical personnel incomes, administrative costs related to both staff and non-staff, and medical interventions. We aimed to examine a counterfactual: what the U.S. could be saving if it spent health care dollars like Canada. To construct this counterfactual, we multiplied U.S. spending on each item by the percent difference in spending between the U.S. and Canada, which gave us dollar amounts for potential savings in each area.

Spending levels are from 2002, since that was the year that most of our data had in common. Overall spending on hospitals and physicians' offices was obtained from CMS (2009) and CIHI (2008). When per capita estimates of spending were not available, they were calculated using Census population projections (Census Bureau 2000; Statistics Canada 2001a). All Canadian dollars were converted to U.S. dollars using the 2002 Purchasing Power Parity (OECD 2009b).

Incomes: Physicians and Staff

Incomes were calculated for physicians, non-physician clinical staff, and non-clinical staff in hospitals and physicians' offices. The percent difference in income between the U.S. and Canada was multiplied by U.S. spending per capita on each type of health care worker to determine the savings that the U.S. could realize through lowering worker incomes to the level of Canada. Spending per capita was defined as the number of personnel multiplied by average income, divided by the population. In the case of physicians, it was the percent difference in the price of generalists that was multiplied by total physician spending, because we hypothesized that higher U.S. specialist prices more

closely reflected the greater intensity of care rather than price.[1] For example, U.S. cardiologists have been shown to treat patients more aggressively than their Canadian counterparts (Rouleau, Moyé, Pfeffer, et al. 1993). To the extent that the greater number of specialist physicians in the U.S. also reflects greater intensity of care, our estimates for U.S. savings will be overstated.

Because we had data only on total physician employment in 2002, but not a breakdown of generalists and specialists, we used 2000 data from an American Medical Association workforce survey on U.S. physician employment by specialty (Pasko and Seidman 2002) to calculate the ratio of generalists to specialists. To estimate the number of generalists and specialists in 2002, we multiplied these ratios by the number of physicians employed in 2002 (Bureau of Labor Statistics (BLS) and Census Bureau 2003). Data on physician income by specialty were obtained from an annual survey in *Medical Economics* (Guglielmo 2003) and were combined with employment data to obtain weighted estimates of income for generalists and specialists.

We used the Canadian Labour Force Survey (LFS) for employment data on Canadian physicians (Statistics Canada 2002). Because the LFS had substantial missing income data, we used 2000 estimates of income (Statistics Canada 2001b), which we inflated by estimated wage growth from 2000 to 2002.[2]

We obtained spending on non-physician staff using the Current Population Survey (CPS) (BLS and Census Bureau 2003), and the LFS, separating clinical from non-clinical staff.[3] We added fringe benefits to reported income by calculating the ratio of benefits to income for various specialties in the U.S., obtained from a *Medical Economics* survey on physician practice expenses (Weiss 2003). For lack of more detailed data, we assumed

that this level was the same in Canada. If fringe benefits are lower in Canada, then our estimate of dollars saved on administration is understated.

Administration: Non-Clinical Staff, Physician Administration, and Non-Staff Spending

We defined administration as consisting of three components: the number of non-clinical staff (rather than their incomes), physician time devoted to administration, and non-staff expenditures. The percent difference in employment or spending was multiplied by U.S. per capita spending on them to calculate the savings that the U.S. could realize by reducing its spending on administration to the level of Canada. Per capita spending was defined, as in the previous section, as the number of employees multiplied by average income, divided by population.

For non-clinical staff, we used the data from the incomes section, but instead took the percent difference in employment per 1000 population and multiplied it by U.S. spending on non-clinical staff.

We used a study by Remler, Gray, and Newhouse (2000) to determine the share of physician time devoted to administrative and insurance tasks in the U.S. The survey was designed to examine whether physicians with greater exposure to managed care spent more time of administrative tasks. The data are from 1995 but were the most recent available. Since then, administrative tasks may have intensified because of the increased complexity of medical care, or decreased because of the reduced penetration of HMOs. For Canada, we used the 2003 Physician Resource Questionnaire to determine the proportion of hours spent on similar tasks: administration and practice management (Canadian Medical Association (CMA) 2003). We multiplied U.S. physicians' administrative share by U.S. spending on physicians (computed in the incomes section) to

calculate the opportunity cost of administrative tasks in the U.S. We then multiplied the percent difference in administrative shares between the U.S. and Canada by this opportunity cost to determine how much the U.S. would save if it lowered the burden of physician administration to the level of Canada.

To determine non-staff expenditures in U.S. physicians' offices, we used the *Medical Economics* survey of practice expenses, which had a breakdown of expenses by type (Weiss 2003). The number of office-based physicians was calculated using the CPS (BLS and Census Bureau 2003) and multiplied by non-staff expenditures to obtain non-staff spending in U.S. physician's offices. To calculate non-staff spending in Canadian physicians' offices, we multiplied average percent overhead (CMA 2002) by spending in Canadian physicians' offices according to the national health accounts (CIHI 2008).

For U.S. hospitals, we calculated non-staff expenditures using the Medicare Cost Report (CMS 2003). We defined these expenses as total non-income costs less contract labor but could not disaggregate these costs further. For Canadian hospitals, we calculated these expenses using data broken down by expenditure type (CIHI 2005). We included drugs, medical supplies, other supplies, and sundries to most closely match the categories in U.S. hospitals.

Higher non-staff spending in U.S. hospitals may reflect greater care intensity since we include drugs and medical supplies, so potential administrative savings may be overstated. However, we hypothesized that the impact on spending of medical equipment and drugs would be higher in hospitals than in physicians' offices. Thus, to separate increased spending due to more intensive care from spending due to increased

administrative costs, non-staff spending in U.S hospitals was multiplied by the percent difference in non-staff expenditures in physicians' offices.

Medical Interventions

We used the National Hospital Discharge Survey (NHDS) (Centers for Disease Control and Prevention (CDC) 2002) and the National Hospital Ambulatory Medical Care Survey (NHAMCS) (CDC 2003) to calculate the number of different types of procedures by diagnosis in hospitals. The DRG weight for each patient was included in these datasets, and was used to calculate the weighted average of DRG weight per diagnosis/procedure pair. For Canada, we obtained the number of different types of procedures by diagnosis using the Discharge Abstract Database (DAD (CIHI 2002-03), which contains data from all provinces except Quebec. Using a crosswalk provided by CIHI, we converted the NHDS and NHAMCS' ICD-9-CM codes to the DAD's ICD-10 codes. Because Canada does not use the DRG system, we assumed the DRG weight for each diagnosis/procedure pair would be the same in Canada.

With these calculations on the average DRG weight per diagnosis/procedure pair, we were able to compute the average DRG weight per capita (weighted by the number of diagnoses). We multiplied the percent difference in DRG weight per capita by total spending in hospitals and total spending in specialist physicians' offices (again, assuming that spending on specialists reflects care intensity more than price). We determined what share of greater intensity was due to higher volume by holding constant the number of diagnoses in the U.S. but reducing DRG weight per diagnosis to the level of Canada; similarly, we determined what share of greater intensity was due to greater severity by

holding constant U.S. DRG weight per diagnosis and reducing the number of diagnoses to the level of Canada.

RESULTS

In 2002, the U.S. spent $1,697 per capita on hospital care and $1,173 per capita on physician services, while Canada spent $891 per capita on hospital care and $390 per capita on physician services. Therefore, the difference in spending between the U.S. and Canada was $1,589 for hospital and physician services combined.

Incomes

Results of incomes differences are reported in Table 1. Generalist physicians earned $154,573 on average in the U.S. and $97,396 in Canada, a 37% difference. Specialists earned $265,257 in the U.S. compared to $124,194 in Canada. With 1.17 generalists and 1.28 specialists per 1000 population in the U.S. and 1.17 generalists and 0.83 specialists in Canada, the weighted average was $212,379 for U.S. physicians and $107,041 for Canadians. Therefore, physician incomes cost $521 per capita in the U.S. and $214 in Canada. The U.S. would save (37% * $521) = $193 per capita if it lowered physician salaries to the level of Canada, 12% of the total difference.

There were 16.17 clinical workers per 1000 population in the U.S. compared to 12.33 in Canada. Their average income was $52,101 in the U.S. and $45,429 in Canada, a 13% difference. Spending on clinical workers was therefore $842 in the U.S. and $560 in Canada. Savings from clinical staff would constitute (13% * $842) = $109 per capita, or 7% of the total difference.

In the U.S., there were 14.24 nonclinical workers per 1000 population with an average income of $48,853, compared to 7.98 workers in Canada with an average income of $35,524, 27% lower than in the U.S. Spending on nonclinical workers was $696 in the U.S. and $283 in Canada. Savings from the price (as opposed to the volume) of nonclinical staff would be (27% * $696) = $188, or 12% of the total difference in spending.

All together, incomes accounted for 31% of the difference in spending, or $490 per capita.

Administration

Results of administrative costs are presented in Table 2. Calculations for nonclinical staff are discussed above. There were 44% fewer nonclinical workers per 1000 population in Canada than in the U.S. Therefore, the U.S. would realize (44% * $696) = $306 per capita in savings if it were to reduce the volume of nonclinical staff to the level of Canada, or 19% of the total difference.

In the U.S., physicians spent about 13% of their time on administrative tasks, while Canadian physicians spent 8% of their time on such tasks, 41% less. As discussed in the previous section, spending on physicians was $521 in the U.S., so the opportunity cost of administration for physicians was (13% * $521) = $70.25; therefore savings from reduced physician administration accounted for (41% * $70.25) = $29 per capita, 2% of the difference in spending.

Non-staff spending was $158 per capita in U.S. physicians' offices and $966 in U.S. hospitals (with the total equal to $158 + $966 = $1124). Canadian physicians' offices spent $119 on non-staff in medical offices (25% less) and $229 in hospitals.

Therefore the savings from non-staff expenditures constituted (25% * $1124) = $281 per capita, or 18% of the total spending difference.

Together, administration accounted for $616, or 39% of the total spending difference.

Medical Interventions: Volume and Intensity

The average DRG weight per capita was about 0.16 in the U.S. and 0.14 in Canada, a difference of 11% (Table 3). As presented in the beginning of the section, $1697 was spent on U.S. hospitals, so the U.S. would save (11% * $1697) = $187 (12% of the total difference) if it reduced the intensity and volume of hospital procedures to the level of Canada. We found that 2 percentage points of the 11% difference in DRG weight per capita were due to a higher volume of patients, while 9 percentage points were due to greater DRG weights per diagnosis.

Because we assumed that spending on specialist physicians more greatly reflected procedures than prices, we also multiplied the 11% difference in DRG weight per capita by spending on specialist physicians, $340, to obtain savings of $37, or 2% of the overall spending difference.

Together, the savings from care received would be $224, or 14% of the difference in spending. Incomes, administration, and medical interventions therefore accounted for (31% + 39% + 14%) = 84% of differing spending between the U.S. and Canada, or $1330 per capita. A summary of these results is presented in Table 4.

DISCUSSION

The U.S. is often criticized for its large expenditures on health care, but the source of this greater spending has not been fully identified. There are three conflicting explanations in the literature. The first is administrative inefficiency: the U.S. spends more because of its fragmented insurance and delivery system (Woolhandler, Campbell, and Himmelstein 2003). The second explanation is that people earn more for providing the same services in the U.S., as emphasized in the memorable title of one article, "It's the Prices, Stupid" (Anderson, Reinhardt, Hussey, et al. 2003). Finally, some studies stress the additional care received in the U.S. (Mark, Naylor, Hlatky et al. 1994). Clearly, not all of these explanations can be the largest. Our analysis considered their relative magnitude. We found that the difference in spending in U.S. and Canadian hospitals and physicians' offices was most greatly attributable to administrative costs (39%), followed by staff prices (31%), and greater volume and intensity of care received (14%). Together, these explanations accounted for 84% of the $1589 cost differential. While it was beyond the scope of this study to determine whether additional spending in the U.S. is warranted, we took the first step in answering this question by determining the major contributors to higher spending and disentangling them from each other. Future research can look to each source to further differentiate wasteful from useful spending.

Our analysis yielded similar results to previous literature. For example, a study by Woolhandler, Campbell, and Himmelstein (2003) found that Canada spent 67 percent less on hospital and practitioner administration in 1999, while this paper found that Canada spent 66 percent less in 2002 (($412+$53.25+$776)/($696+$70.25+$1,124)). These similar results hold even though their methods were slightly different. For example, they included in their calculations the opportunity cost of non-physician clinical

staff time spent on administration, while we only accounted for physician time, and they excluded some categories of non-staff expenditures that we used in this paper.

The main limitation of this study is its inability to perfectly differentiate prices, administrative costs, and medical interventions. For example, if generalist physicians in the U.S. earn more because they perform more payable procedures, not because their fees are higher, then we may have overestimated the impact of prices on spending. Another unknown is how much of non-staff spending is associated with administration, and how much reflects greater intensity of care. We assumed that such spending in physicians' offices was entirely the result of greater administrative expense. Given the increasing number of procedures performed on an outpatient basis, however, this assumption may have been an overstatement. We cannot quantify either of these possibilities because we do not have data on the volume and intensity of procedures performed in physicians' offices.

On the other hand, our inability to perfectly differentiate sources of spending may have understated some costs. For example, because we multiplied the percent difference in generalist prices by total spending on physicians, we may also have understated price differences in specialists that were not attributable to care intensity alone. The same argument applies to our treatment of non-staff costs, where the percent difference in physicians' offices was multiplied by administrative spending, which may have understated non-staff costs in hospitals that were not due to care intensity. These understated costs may help account for the 16 percent of spending that we do not explain. The missing costs may also come from expenses like contract labor in hospitals that we could not capture in our analysis.

Further, we look only at hospitals and physicians' offices and ignore other areas where prices, administrative costs, or clinical intensity may have a substantial impact, such as prescription drugs (prices) and the health insurance industry (administrative costs). In the paper by Woolhandler et al. (2003), the authors conducted a separate analysis of health insurance overhead and found that Canada spent 82 percent less on this area of administration.

Using purchasing power parity as a price adjuster could be problematic. In the U.S., a bundle of consumer goods includes much more medical care, whereas medical care in Canada is financed by taxes. In this case, U.S. prices could be inflated. This problem was partially offset by our equal treatment of fringe benefits across countries.

An additional concern is that the intensity of medical care is not accounted for in the same way in the U.S. as in Canada. Since Canada does not use DRG weights to pay hospitals, we had to assume that the DRG weight for each diagnosis/procedure pair was the same in the U.S. as in Canada. However, because Canadians have been found to have lower levels of disability (Pozen and Cutler 2009), their DRG weights may be overstated, so the U.S.-Canada difference may be understated.

That cost savings can be realized does not necessarily mean that these savings are desirable. Paying more for the same service seems wasteful. However, in both the U.S. and Canada, physicians are rivaled in pay only by senior managers and Chief Executive Officers (Statistics Canada 2001b; BLS 2000). If the supply of physicians depends on the incomes of other highly trained people, physician incomes in the U.S. may not be so excessive compared to Canada.

Further, defining administration is crucial to separating wasteful spending from non-wasteful spending. Canadian spending on administration may be lower because it has more streamlined payments to providers through its single-payer system, or it may be because rent is lower and equipment is cheaper than in the U.S. While complex payments may be considered wasteful, higher office overhead may not. A close analysis of non-staff expenditures must be performed to answer this question. Data from the U.S. showed that malpractice insurance, office space, and utilities were the largest components of administrative spending. Equipment rental and maintenance were somewhat less important, and automobiles, continuing medical education and laboratory expenses were relatively low (Weiss 2003). However, non-staff expenditures in Canada were not broken out the same way that they were in the U.S. so these expenditures could not be compared.

We found that DRG weight per capita was higher in the U.S., predominantly because of more intensive interventions. A central question is whether this greater intensity is justified clinically. This question has not yet been resolved. For example, studies in cardiac care have shown that although the U.S. treats patients more aggressively than Canada, outcomes are sometimes better in the U.S. (Kaul, Armstrong, Chang, et al. 2004) and other times better in Canada (O'Hara, Charbonneau, Chandler, et al. 2005).

In sum, we found that administrative costs accounted for the greatest proportion of spending differences between the U.S. and Canada, followed by prices and medical care provision. Further research must be done to determine whether additional U.S. expenditures are wasteful.

Table 1: Comparison of Earnings in the US and Canada

	U.S.	Canada*	Difference (%)
Physician incomes			
Generalist	$154,573	$97,396	$57,177 (37%)
Specialist	$265,257	$124,194	$141,063 (53%)
All physicians	$212,379	$107,041	$105,338 (50%)
Physicians/1000 population	2.46	2.00	0.46 (19%)
Spending per capita**	$521	$214	$307 (59%)
Savings from lower incomes	**$193**		
Clinical staff			
Average annual income	$52,101	$45,429	$6,672 (13%)
Staff/1000 population	16.17	12.33	3.84 (24%)
Spending per capita**	$842	$560	$282 (34%)
Savings from lower incomes	**$109**		
Nonclinical staff			
Average annual income	$48,853	$35,524	$13,329 (27%)
Staff/1000 population	14.24	7.98	6.26 (44%)
Spending per capita**	$696	$283	$412 (59%)
Savings from lower incomes	**$188**		
Effect of income differences* **	**$490**		

*Adjusted to U.S. dollars using PPP
**Income multiplied by staff/1000 divided by 1000
***Combined savings from physicians and staff

Table 2: Comparison of Administrative Costs in the U.S. and Canada

	U.S.	Canada*	Difference (%)
Nonclinical staff			
Average annual income	$48,853	$35,524	$13,329 (27%)
Staff/1000 population	14.24	7.98	6.26 (44%)
Spending per capita**	$696	$283	$412 (59%)
Savings from fewer staff	**$306**		
Physician administration			
Share of physician time devoted to administration	0.13	0.08	0.06 (41%)
Spending per capita on physicians**	$521	$214	$307 (59%)
Opportunity cost of administrative share***	$70.25	$17.00	$53.25 (76%)
Savings from lower administrative share	**$29**		
Non-staff expenditures			
Non-staff spending in physicians' offices per capita	$158	$119	$39 (25%)
Non-staff spending in hospitals per capita	$966	$229	$737 (76%)
Total non-staff spending per capita	$1,124	$348	$776 (69%)
Savings from lower non-staff expenditures	**$281**		
Total administrative savings	**$616**		

*Adjusted to U.S. dollars using PPP
**Income multiplied by staff/1000 divided by 1000
***Administrative share multiplied by spending per capita

Table 3: Impact of Procedure Use on Spending Differentials

	U.S.	Canada*	Difference (%)
Total hospital spending per capita	$1,697	$891	$806 (47%)
Total specialist spending per capita	$340	$103	$236 (70%)
Average DRG weight per capita	0.16	0.14	0.02 (11%)
Diagnoses per capita	0.141	0.138	0.003 (2%)
Average DRG weight per diagnosis	1.142	1.032	0.11 (10%)
Savings from lower DRG weight per capita	**$224**		

*Adjusted to U.S. dollars using PPP

Table 4: Summary of Results

	Dollars Saved per Capita	Percent of Total Difference
Total Difference	$1,589	100%
Incomes		
Physicians	$193	12%
Clinical staff	$109	7%
Non-clinical staff	$188	12%
Total savings on prices	$490	31%
Administration		
Non-clinical staff	$306	19%
Physician time	$29	2%
Other expenses	$281	18%
Total savings on administration	$616	39%
Care Received		
Inpatient and outpatient hospital care	$187	12%
Specialist physician spending	$37	2%
Total savings on care received	$224	14%
TOTAL DOLLARS SAVED	$1,330	84%

Endnotes

[1] Generalists were defined as family practitioners, general practitioners, internists, OBGYNs, pediatricians, family practice subspecialties, and internal medicine subspecialties. Specialists were defined as invasive and non-invasive cardiologists, gastroenterologists, general surgeons, orthopedic surgeons, allergy and immunology, dermatology, epidemiology, pediatric allergy, pediatric cardiology, other pediatric subspecialties, pulmonary diseases, colon/rectal surgery, neurological surgery, ophthalmology, otolaryngology, plastic surgery, thoracic surgery, urology, aerospace medicine, anesthesiology, child psychiatry, diagnostic radiology, general preventive medicine, medical genetics, neurology, nuclear medicine, occupational medicine, pathology and forensic pathology, physical medicine and rehabilitation, psychiatry, public health, radiology, and radiation oncology.

[2] Because of limited data, we obtained the wage growth from 2000 to 2002 in a roundabout way. We had information on specialist and generalist physicians' wage growth from 2000 to 2005 from Statistics Canada. We then estimated what proportion of this growth was accounted for by growth between 2000 and 2002 by looking at national health care spending. The growth rate of annual spending was 17% from 2000 to 2002 and 23% from 2002 to 2005. Therefore 43% of the growth rate from 2000 to 2005 could be attributed to growth from 2000 to 2002. We multiplied this percentage by the growth rate in income for Canadian physicians between 2000 and 2005 to obtain an estimated 2000 to 2002 growth rate, which was 8% for specialists and 3% for generalists. We then increased 2000 salaries by this amount, as well as by the inflation rate from 2000 to 2002 (4.99%).

[3] We defined clinical workers in the U.S. as: dieticians and nutritionists, pharmacists, physician assistants, registered nurses, audiologists, occupational therapists, physical therapists, radiation therapists, recreational therapists, respiratory therapists, speech-language pathologists, therapists (all other), health diagnosing and treating practitioners (all other), clinical laboratory technologists and technicians, diagnostic related technologists and technicians, emergency medical technicians and paramedics, health diagnosing and treating practitioner support technicians, licensed practical and licensed vocational nurses, medical records and health information technicians, dispensing opticians, miscellaneous health technologists and technicians, other healthcare practitioners and technical occupations, nursing, psychiatric, and home health aides, occupational therapist assistants and aides, physical therapist assistants and aides, massage therapists, and medical assistants and other healthcare support occupations. Non-clinical workers were defined as all others.

We defined clinical workers in Canada as: pharmacists, dieticians, nutritionists, therapy and assessment professionals, nurse supervisors, registered nurses, medical technologists and technicians, registered nursing assistants, ambulance attendants and other paramedical occupations, other technical occupations in therapy and assessment, and assisting occupations in support of health services. Non-clinical staff included management occupations, business, finance, and administration occupations, natural and applied sciences and related occupations, social science, education, government service, and religion, sales and service occupations, trades, transport and equipment operators and related occupations, and occupations unique to processing manufacturing, and utilities.

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