

# **Workplace Accident-Related Finger-Fracture at the Mexican Institute of Social Security.**

## **Resolution Time, Economic Impact and Sequelae**

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### **RESUMEN**

**Objetivo:** identificar el tiempo de resolución y el impacto económico que representa la incapacidad permanente de fracturas en dedos de mano por accidente de trabajo.

**Material y métodos:** se realizó estudio transversal en 2004; las variables fueron diagnóstico, edad, sexo, días de incapacidad temporal, secuelas valiables y delegación. Se utilizó la Clasificación Internacional de Enfermedades, se realizó análisis de frecuencias y días de incapacidad excedidos y estimación de costos por incapacidades, pensiones y gastos indirectos. Se aplicó  $\chi^2$  para identificar diferencias.

**Resultados:** se presentaron a nivel nacional 13 410 fracturas de dedos, 803 fracturas múltiples de dedos de la mano, 1982 del pulgar y 10 625 de otro dedo ( $p < 0.001$ ); promedio de días para resolución de fracturas múltiples 70.5, fractura del pulgar  $50 \pm 40$ , fractura de otro dedo 51.1. Tasa de IPP fractura pulgar  $5.3 \times 100$ , fracturas múltiples 15.8, fractura de otro dedo 5.9. El costo global estimado para el Instituto Mexicano del Seguro Social por incapacidad temporal fue de \$117 359 067.00, y el costo por incapacidad permanente de los casos de finiquitos y pagos de pensiones anuales, de \$8 343 899.28 ( $p < 0.001$ ).

**Conclusiones:** las fracturas de dedos de la mano representan una patología prevalente que amerita revisar los procedimientos médicos, identificar los factores y establecer acciones de mejora que limiten el daño en los trabajadores. Se debe considerar que esta patología afecta la productividad de las empresas y disminuye la calidad de vida de los trabajadores.

### **SUMMARY**

**Objective:** to identify resolution time and economic impact of occupational finger fracture with permanent disability.

**Methods:** A cross-sectional study was conducted in 2004; the main variables were age; sex; disability days and sequelae. The International Classification of Diseases (ICD 10) was used for the study. The analysis included frequency, exceeded disability days and estimation of cost of disabilities, pensions and direct costs. Chi square test was used to identify the differences.

**Results:** 13 410 fractures occurred nationwide: multiple finger fractures (803); thumb fractures (1982) and other finger fractures (10 625). Days of resolution time were: 70.5 days for multiple finger fractures and 51.1 days for another finger fractures. Permanent disability partial rate of thumb fracture was 5.3/100, 15.8/100 multiple finger fractures and 5.9 fractures of other finger. The estimated cost by temporary disability in the Instituto Mexicano del Seguro Social was on \$10 669 000 U.S., while permanent disability costs in cases of settlements and annual pension payments were \$758 536 U.S.

**Conclusions:** finger-fracture is a prevalent pathology whichever needs that medical procedures are review, also identify factors that decrease resolution time and establish improve actions that create boundaries on the workers damage health. It must be considered that this condition affects enterprise' productivity and decrease the quality of life from workers.

### **Palabras clave**

- ✓ fractura en dedos
- ✓ accidentes de trabajo
- ✓ costos de lesiones
- ✓ evaluación de la discapacidad
- ✓ economía médica

### **Key words**

- ✓ finger injuries
- ✓ occupational accidents
- ✓ cost of illness
- ✓ disability evaluation
- ✓ medical economics

## **Introduction**

The medical care quality of the key topics in the provision and planning of Health Services. Timely provision and rational use of medical care with reasonable costs is an ongoing concern in all countries of the world. Given that health costs have grown substantially over the past years, studies on expense variations in costs for medical management by specific pathology have increased in public and private health institutions.<sup>1</sup> Investigation of results broadens the traditional concept of clinical investigation with regard to the effectiveness of medical actions, which takes into account the final results that measure technical success as well as patient satisfaction. Within relevant aspects is found the establishment of the relative effectiveness of the different interventions, which permits identification of poor or ineffective effective treatments for their modification or elimination, thus promoting healthy competition among the different organizations.<sup>2,3</sup>

In Mexico, the prescription of temporary work incapacity is granted to the worker when he/she is unable to carry out his/her work due to the presence of some pathology, and has as its objective the temporary interruption of workplace activities so that treatment or rehabilitation may be effected under optimal conditions with the least amount of injuries and in the shortest time possible; thus, adequate prescription has an influence on temporary incapacity time and covers part of the quality of medical care.<sup>4</sup> Temporary work incapacities generate payment of subsidies, which in some countries represent an elevated economic division, reaching up to 8 % of social security provisions. This has justified the development of specific programs to decrease the number of temporary work incapacity days,<sup>5</sup> in addition to establishing strategies to guarantee quality and improvement by means of multidisciplinary healthcare teams.<sup>6</sup> With regard to workplace accidents that occurred during 2004 at the Mexican Institute of Social Security (IMSS), hand injuries occupied 37 % of lesions, while finger fractures represented 3.3 %, with 13 410 cases that required 798 000 temporary incapacity days for resolution.<sup>7</sup> Therefore, it is relevant to evaluate and improve the

quality of medical care provided to workers who suffer a hand injury, and especially in cases of finger fractures, because with this we are able to ascertain the extenuating circumstances of these fractures, such as temporary work incapacity days and anatomofunctional sequelae. An example of this is the work by Juárez,<sup>8</sup> who indicates that use of Kirschner nails instead of plates and screws in diaphyseal metacarpal fractures results in less immobilization time and functional improvement in fingers. Maldonado et al.<sup>9</sup> refer that an important number of cases with workplace accident-derived prolonged temporary incapacity cases are due to hand fractures, contusions, wounds, and amputations, which are generated by medical and administrative management problems. Therefore, we developed this investigative work setting the importance of this pathology with regard to medical care quality and Mexican Institute of Social Security (IMSS) costs as well as worker and institutional repercussions.

## **Materials and methods**

We carried out a transversal and observational study that contemplated the universe composed of workers affiliated by the IMSS who suffered finger fractures characterized as workplace accidents and that were included in IMSS worker rolls in 2004. The source of information was the institutional work-risk registry subsystem that contains data provided by health-at-work institutional services, as well as the monthly information system on subsidies and pensions determined by the IMSS Economic Provisions Area. Study variables included diagnosis, age, gender, temporary incapacity days, permanent incapacity, and IMSS delegation. Selected diagnoses comprised multiple finger fractures, thumb fracture, and workplace accident-associated fracture of another finger.

The cases were selected from SUI-55/ST-5 system (unique information system on occupational health) of occurred and finished cases at national scope. The quality of information was settled on each case had its dictation, medical traumatologic notes and in 95 % X-Rays studies.

Temporary disability costs of each case were obtained by taking into account average number of days and average cost per day of subsidized disability during 2004 \$11.6 U.S., for the permanent disability payment, in cases lower than 25 %, the IMSS grant a unique payment (liquidation) which is calculated multiplying the percentage of disability valuation and the daily gauge for 5 years. In cases with more than 25 %, a monthly pension is determined multiplying the percentage of disability and the gauge of the worker while the disability persists. In the present study it was applied this procedure considering costs of liquidations and in cases with more than 25 % the costs of a pension corresponding to the first year. Diagnoses were coded according to the tenth edition of the IDC-10.<sup>10</sup> Statistical analysis comprised simple frequency analyses, central trend measurements, standard deviations (SD), and chi squared test to identify differences.

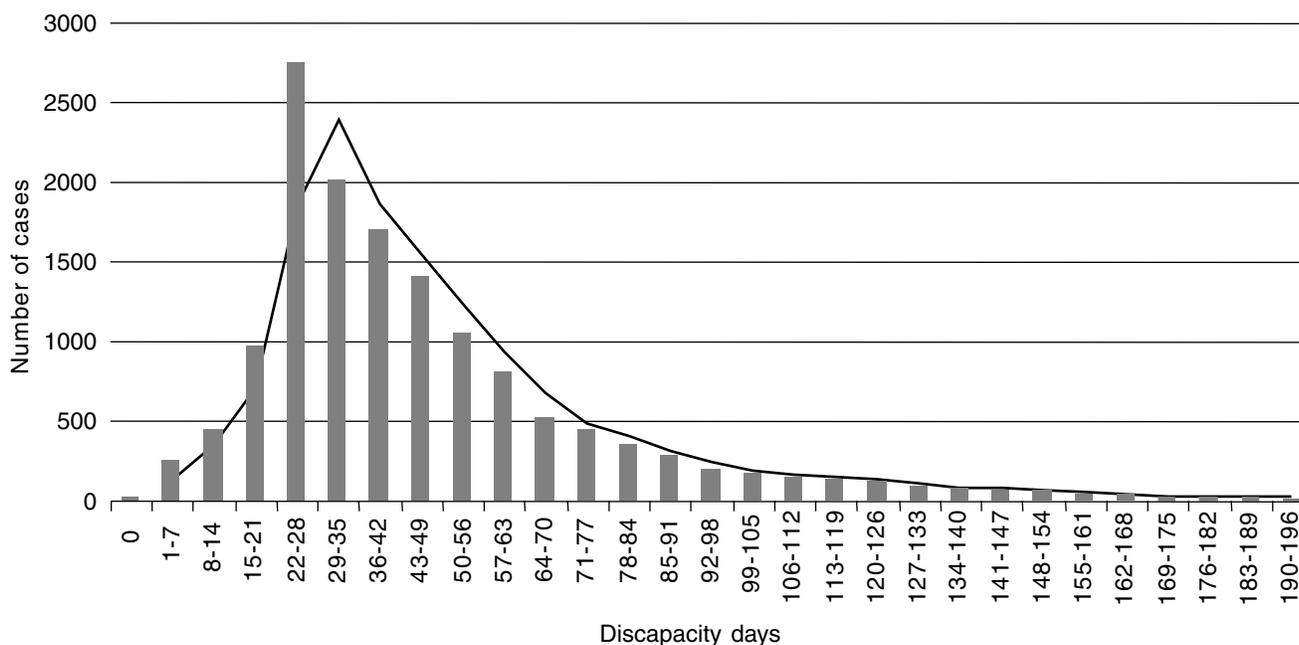
The analysis of contrast or differences between time and disability costs with the severity of the damage and anatomic region affected was not made, due to in the present is just a descriptive study.

## Results

In 2004, we were able to identify and quantify a total of 360 793 workplace-related risks at the IMSS national level, of which 282 469 (78 %) were workplace accidents, 70 906 (20 %) were workplace-trajectory accidents and 7418 (2 %) were occupational diseases. The anatomic region most frequently affected was wrist and hand with 115 811 cases. Fingers presented 13 410 fractures, of which 10 625 (79 %) were fractures of other fingers, 1982 (15 %) were thumb fractures, and 803 cases (6 %) were multiple finger fractures.

The 13 410 finger fractures generated 698 687 temporary disability days, with a national average per case of 52.1 days, the highest number within the range of 15–56 days (70 %) (figure 1). The age group presenting longest resolution time for the different types of finger fracture was the 45–54-years-of-age group; a significant difference was identified ( $p < 0.01$ ) among age groups for both sexes. Multiple finger fractures presented longest resolution time (table I).

On analyzing behavior by IMSS Delegation, the central Mexican Delegations of Na-



**Figure 1. Workplace-related finger-fracture resolution time 2004. Source: Unique Subsystem of Information on Occupational Health SUI55/ST5 (cases), 2004. Information System of Economic Benefits (disability days) 2004.**

yarit, Querétaro, and Jalisco presented the lowest disability averages for resolution, while northern Mexican Delegations (Baja California Norte, Zacatecas, and Chihuahua) exhibited highest disability averages ( $p < 0.01$ ) (table II).

IMSS Delegations with the lowest rates of permanent disability due to finger fracture were Nayarit, Querétaro, and Guerrero, with figures up to 1.6, while highest rates were found in Zacatecas (13.8), San Luis Potosí (14.8), and Tlaxcala (17.3), results that duplicated the IMSS national rate. Average valuation percentage per case at the national level was 12 % with a range of 0-39 %. IMSS Delegations with highest percentages were Guerrero (39 %), State of Mexico East (38.8 %), and Baja California (29.8 %) (table III). Payment of permanent disability-related pensions in cases of final settlements per annum was \$ 903 019 U.S.

## Discussion

Resolution time of finger-fracture types in all IMSS Delegations was  $> 35$  days as reported

in the national and international literature for recuperation of this pathology in workers with these work-medium physical requirements.<sup>11,12</sup>

With regard to recuperation period by Delegation, we identified an important variation in resolution time among the different IMSS Delegations, that is  $> 25.5$  days per case. It is important to point out that there exist differences among IMSS Delegations with respect to infrastructure and human resources for care of this finger-fracture pathology.

We identified IMSS Delegations that coincided with lowest average days for case resolution and lowest rate of permanent disability (Nayarit, Querétaro, Colima, Quintana Roo, and Aguascalientes), as well as IMSS Delegations with highest average number of days per case and highest permanent disability rate (Zacatecas, Chihuahua, San Luis Potosí, Veracruz South, 2 Federal District Northeast, Tlaxcala, Veracruz North, and Guanajuato); thus, it would be convenient in the future to review the causes of this behavior.

Finger fractures represent 3.2 % of pathologies occasioned by occupational risks; nonetheless, they consumed  $> 8$  % of disability

**Table I**  
**Finger-fracture resolution time by diagnosis, sex, and age group in the IMSS National level, 2004**

	Average resolution time (days)	Age/sex	Minimum and maximum values		
			Thumb fracture	Another finger fracture	Multiple finger fractures
Male	<15	<15	28.5-12.3	33.0- 9.0	41.5-29.0
Female	<15	<15	—	66.5-20.5	—
Male	15-24	15-24	43.8-36.5	47.2-62.6	65.0-53.0
Female	15-24	15-24	44.5-31.3	49.0-46.4	75.0-50.1
Male	25-34	25-34	51.6-51.1	50.5-45.4	71.0-55.4
Female	25-34	25-34	43.2-30.7	49.0-37.0	73.0-61.0
Male	35-44	35-44	52.0-33.6	53.6-44.2	74.2-57.0
Female	35-44	35-44	50.0-49.0	53.0-45.0	71.0-61.5
Male	45-54	45-54	61.0-45.0	57.0-62.0	77.0-54.0
Female	45-54	45-54	58.5-38.0	68.2-53.8	75.5-40.3
Male	55-64	55-64	52.2-26.0	53.0-39.0	56.0-57.0
Female	55-64	55-64	48.5-9.2	48.0-35.7	42.0-0
Male	65 or more	65 or more	—	64.4-42.8	211.0-0
Female	65 or more	65 or more	—	28.0-0	—

Source: Unique Subsystem of Information on Occupational Health SUI-55/ST5. SIMECI 2004

ity days generate nationally.<sup>13</sup> It is noteworthy to point out that we found five IMSS Delegations that were > 12 %.

Resolution time behavior for finger fractures was greater according to increase in age

of workers of both sexes, which is in agreement with other authors.<sup>14</sup> It is worthwhile to indicate here the importance of resolution time, where can exist technical differences for resolving this type of pathology with similar results

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**Table II**  
**Finger-fracture resolution time and economic cost by Mexican Institute of Social Security Delegation and National 2004**

Delegation	Cases	Incapacity days awarded	Average	Required discapacity days (35 days per case)	Exceeded discapacity days	Economic amount in \$ U.S., exceeded discapacity days
Nayarit	61	2 342	38.4	2 135	207	2 419
Querétaro	325	13 935	42.9	11 375	2 560	29 922
Jalisco	1 183	52 214	44.1	41 405	10 809	126 339
Colima	81	3 654	45.1	2 835	819	9 573
Quintana Roo	93	4 295	46.2	3 255	1 040	12 156
Nuevo León	1 571	72 702	46.3	54 985	17 717	207 082
Aguascalientes	233	10 845	46.5	8 155	2 690	31 442
Yucatán	157	7 314	46.6	5 495	1 819	21 261
Puebla	305	14 275	46.8	10 675	3 600	42 078
Oaxaca	95	4 527	47.7	3 325	1 202	14 049
Morelos	151	7 300	48.3	5 285	2 015	23 552
Hidalgo	137	6 908	50.4	4 795	2 113	24 697
Michoacán	150	7 576	50.5	5 250	2 326	27 187
Guerrero	64	3 234	50.5	2 240	994	11 618
3 D.F. Suroeste	406	20 637	50.8	14 210	6 427	75 121
Tamaulipas	586	29 861	51.0	20 510	9 351	109 297
Coahuila	929	47 504	51.1	32 515	14 989	175 196
Chiapas	69	3 530	51.2	2 415	1 115	13 032
Durango	336	17 300	51.5	11 760	5 540	64 753
Sonora	319	16 681	52.3	11 165	5 516	64 473
Baja California Sur	504	26 902	53.4	17 640	9 262	108 257
1 D.F. Noroeste	685	36 833	53.8	23 975	12 858	150 288
Edo. Méx. Poniente	374	20 449	54.7	13 090	7 359	86 014
Sinaloa	281	15 494	55.1	9 835	5 659	66 144
Tabasco	55	3 038	55.2	1 925	1 113	13 009
Guanajuato	591	32 721	55.4	20 685	12 036	140 681
Veracruz Norte	270	15 059	55.8	9 450	5 609	65 560
Campeche	78	4 369	56.0	2 730	1 639	19 157
Tlaxcala	52	2 930	56.3	1 820	1 110	12 974
2 D.F. Noreste	235	13 251	56.4	8 225	5 026	58 745
Veracruz Sur	212	12 307	58.1	7 420	4 887	57 121
San Luis Potosí	344	20 032	58.2	12 040	7 992	93 413
Edo. Méx. Oriente	1 038	61 422	59.2	36 330	25 092	293 283
4 D. F. Sureste	542	32 324	59.6	18 970	13 354	156 086
Chihuahua	645	38 949	60.4	22 575	16 374	191 384
Zacatecas	58	3 506	60.4	2 030	1 476	17 252
Baja California	195	12 467	63.9	6 825	5 642	65 945
National	13 410	698 687	52.1	469 350	229 337	2 680 562

Source: Information System of Economic Benefits, Unique Subsystem of Information on Occupational Health SUI55/ST5, 2004. SIMECI, 2004

regarding to complications, mobility, and presence of pain; nevertheless, resolution time can be much greater, as shown in the results of the Horton study;<sup>15</sup> mean resolution of the same pathology in one technique was 3 weeks and

with the other technique, 1 week, a situation that affects the worker's opportunity for reincorporation and temporary incapacity costs.

In addition to considering temporary work-incapacity days and indemnization and pension

**Table III**  
**Permanent workplace-associated finger fracture-related incapacity rate in Mexican Institute of Social Security by Delegation and National 2004**

Delegation	Fracture cases	Permanent incapacity partial cases	Permanent incapacity partial rate by 100 Fx	Average percentage of permanent incapacity per case
Nayarit	61	0	0.0	0.0
Querétaro	325	4	1.2	12.0
Guerrero	64	1	1.6	39.0
Quintana Roo	93	2	2.2	7.0
Baja California Sur	504	12	2.4	3.7
Edo. Méx. Oriente	1 038	26	2.5	38.8
Baja California	195	6	3.1	29.8
3 D.F. Suroeste	406	15	3.7	6.5
Sonora	319	12	3.8	12.3
Tamaulipas	586	24	4.1	12.4
Chiapas	69	3	4.3	6.7
Sinaloa	281	13	4.6	12.3
Morelos	151	7	4.6	9.3
Aguascalientes	233	11	4.7	17.4
Colima	81	4	4.9	4.3
Hidalgo	137	7	5.1	7.1
Coahuila	929	48	5.2	7.5
4 D.F. Sureste	542	31	5.7	13.0
Jalisco	1 183	68	5.7	8.3
Campeche	78	5	6.4	6.2
Michoacán	150	10	6.7	8.6
Guanajuato	591	40	6.8	14.4
Nuevo León	1 571	108	6.9	13.6
1 D.F. Noroeste	685	48	7.0	16.6
Puebla	305	22	7.2	14.8
Tabasco	55	4	7.3	6.8
Oaxaca	95	7	7.4	6.6
2 D.F. Noreste	235	19	8.1	11.3
Veracruz Norte	270	22	8.1	7.0
Yucatán	157	15	9.6	6.9
Edo. Méx. Poniente	374	36	9.6	8.7
Durango	336	34	10.1	14.5
Chihuahua	645	69	10.7	11.6
Veracruz Sur	212	23	10.8	7.7
Zacatecas	58	8	13.8	6.9
San Luis Potosí	344	51	14.8	9.5
Tlaxcala	52	9	17.3	9.1
National	13 410	824	6.1	12.0

Source: Information System of Economic Benefits, Unique Subsystem of Information on Occupational Health SUI55/ST5, 2004. SIMECI, 2004

costs, it is convenient to contemplate the magnitude of costs generated by medical care<sup>16</sup> based on the study carried out by Chain et al.,<sup>17</sup> which included as variable costs antibiotics, anti-inflammatory drugs, analgesics, tetanus toxoid, plaster casts, elastic bandages, sutures, X-ray and laboratory studies, hospitalization days, and gammaglobulin, and as semivariable costs emergency consultations, Family Medicine appointments, consultations of another medical specialty, and physical and surgical medicine sessions. Estimated per-case cost was \$1374 U.S., this multiplied by 13 410 cases represented a total of \$18 425 688 U.S., which when added to temporary incapacities and pensions represented a cost of \$30 300 000 U.S. Therefore, it is convenient to consider adequate measures of management to this pathology at the different levels of medical care. For example, we cite the Clinical Practice Guides for Management of Traumatic Hand Injuries in Family Medicine, which was developed by Reyes et al.,<sup>18</sup> and which sets algorithms that allow to establish a more certain diagnosis and timely and adequate treatment, and the identification of whether the case due to its complexity should be referred to another level of medical care. Because we found an important variation of permanent disability rate per Delegation of 0 to 17, it was analyzed if the number of human resources of traumatology and physics are similar or different between the 6 Delegations with upper and lower permanent disability rate, identifying an heterogeneous data between the number of human resources to attend the cases, due to the Querétaro Delegation attends in average 12 cases per traumatologist, 81 cases per physician, with a permanent disability rate of 1.2, against Tlaxcala which attends 4.7 cases per traumatologist and 26 cases per physician, with a rate of 17.3. This situation could be caused by several factors as the technological resources, availability and admittance to the traumatology services, initiation of adequate rehabilitation, which diminishes recuperation time in terms of incapacity days and degree of sequelae.<sup>19</sup>

Workplace accident-related finger fractures present a longer resolution time in all IMSS Delegations, which agrees with reports in the international literature. This situation generates a higher expenditure in subsidies and indirect

expenses; thus, it is necessary to continue with future investigations that consents unification of medical procedures for management of finger fractures, medical-type factors such as technical ability and reasoning for incapacity prescriptions, and non-medical aspects such as infrastructure, furniture and other negotiable goods, and demand for service that influence the quality of medical care. Future investigations should also identify the cost-benefit of multidisciplinary team integration at different medical care levels who are dedicated to providing care for hand injuries, and investigations that additionally evaluate the impact on reducing resolution time and degree of sequelae, as well as the behavior of the worker's timely reincorporation at work.

Time resolution was higher than resolution time reported in the literature, which generates 229 337 additional incapacity days with an extra cost of \$2 251 667 U.S.

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