厚生労働科学研究費補助金（地球規模保健課題推進研究事業）

分担研究報告書

日本外傷データバンクの経験を活用した 途上国における鈍的外傷患者の生存予測に関する研究

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研究要旨

昨度の研究を行う中で、以前筆者の日本外傷データバンク（JTDB）での研究[1]で示されたように、タイ国コンケン地域病院外傷センターの外傷登録データ（KKTR）においても、呼吸数(RR)が、予測生存確率（Ps）にあまり関与していない予測変数であることが明らかになってきた。また、JTDBでは予測変数として、コード化された(c)年齢を使用するよりも実年齢（AY）を用いた方が、より良いモデルを作成することが知られているが[1]、KKTRでも同様のことが言えるのではないかとの仮説のもと、本年度の研究を行った。2005~2008年の間、JTDBに登録された生死の情報がありかつPs計算可能な鈍的外傷データ15,524と同期間にKKTRに登録された同様の基準で選択されたデータ 6,411を対象とした。TRISS法[2]で用いられるRevised Trauma Score (RTS)[3]の代わりにその構成要素である収縮期血圧(SBP)、Glasgow Coma Scale (GCS)スコアをコード化したcSBPとcGCS を予測変数として用いcRRについては予測変数に加えたロジスティック回帰モデルと加えないモデルを作成した。また、cAYの代わりにAYを用いたモデルを作成した。その結果両国のデータにおいて、cAYよりAYを用いた方がよりよいモデルが作成された。また同様に両データにおいてcRRを省いても、cRRを用いたモデルに比較して適合性はほとんど落ちず、識別能も保持された。

A．研究目的

日本外傷データバンク Japan Trauma Data Bank (JTDB)並びにタイ国コンケン地域病院外傷センターの外傷登録データ（KKTR）において、呼吸数(RR)が、予測生存確率（Ps）にあまり関与していない予測変数であること、また予測変数として、コード化(c)された年齢(cAY)を使用するよりも、実年齢(AY)を用いてTRISS法[2]に準じたモデルを作成する方が、より良いことを証明する目的で本年度の研究を行った。

B．研究方法

2005~2008年の間に、JTDBに登録された日本外傷学会トラウマレジストリー委員会にて洗浄された鈍的外傷患者25,310例の登録データ使用した。その内、生死情報の欠損値が無くかつ Trauma and Injury Severity Score (TRISS) 法でPs計算が可能となる予測変数が全て入力されている患者データは15,524であり、それを解析に用いた。

タイ国コンケン地域病院外傷センターに2005年から2008年に登録された鈍的外傷患者6,667例のうち、生死情報の欠損値が無くかつ TRISS法でPs計算が可能となる予測変数が全て入力されている6,409例のデータを用いた。

ロジスティック回帰分析では、予測変数には、Injury Severity Score (ISS)[4]、RTS[3]の他に、年齢(以下AY)、GCSスコア、SBP、RRとそれぞれコード化したcAY、cGCS、cSBP、cRR (Table 1) を用い、目的変数は生死の名義変数とした。パラメタの推定法としては、最尤推定法を用いた。モデル間の適合度の比較には、赤池情報量基準（以下AIC）を用い、同じデータを用いた際、より低いものほど当てはまりのよいモデルと判断した。識別能は、receiver operating characteristic 曲線下面積(以下AUROCC)で評価した。

統計処理コンピュータソフトウエアーには、JMP 90（SAS社）を用いた。

C．研究結果

Table 1. 各変数の分布とコード

	Coded value	JTDB Data	KKTR Data
Number		15,524	6,411
Gender (male %)		69.20%	74.10%
Age year mean (SD)		48.5 (23.2)	31.6 (18.9)
AY<55	0	55.00%	87.60%
AY≧55	1	45.00%	12.40%
RTS mean (SD)		6.78 (2.13)	7.47 (1.08)
SBP: >89 mmHg	4	86.30%	95.90%
SBP: 76-89 mmHg	3	3.20%	1.60%
SBP: 59-75 mmHg	2	2.40%	1.10%
SBP: 1-49 mmHg	1	1.30%	0.20%
SBP: no pulse	0	6.80%	1.20%
GCS score 13-15	4	73.80%	89.40%
GCS score 9-12	3	7.30%	3.00%
GCS score 6-8	2	5.90%	4.60%
GCS score 4-5	1	2.20%	1.10%
GCS score <4	0	10.80%	1.90%
RR: 10-29/min	4	77.90%	92.10%
RR: >29 /min	3	14.30%	0.20%
RR: 6-9 /min	2	0.40%	0.02%
RR: 1-5 /min	1	0.20%	0.20%
RR: 0 /min	0	7.20%	7.50%
ISS mean (SD)		17.9 (13.6)	9.5 (10.1)
Survival		85.00%	95.90%

JTDBでは、 若年患者（AY < 55, cAY = 0）の生存割合 は88.13%であり、年長患者(AY ≥ 55, cAY = 1)の81.25%より若干高いのみであった。KKTRでは,生存割合 は､若年患者で95.92%､年長患者で95.86%と殆ど違いはなかった。

Table 2. 各モデルの赤池情報量基準(AIC)の比較

Predictor variables of each regression model	AIC JTDB	AIC KKTR
ISS, RTS, cAY	4372	1120
ISS, RTS, AY	**4305**	1109
ISS, AY, cSBP, cGCS, cRR	**4305**	**1105**
ISS, AY, cSBP, cGCS	4347	**1105**

AY を予測変数として用いたモデルの AIC は、TRISS法で行われているcAY を用いるものより低かった。ISS, AY およびRTSの代わりに cGCS、cSBP、cRR を用いたモデルの AIC はもっとも低く JTDB で 4,305 、KKTR で 1,105 であった。KKTR では cRR を予測変数から除外しても AIC の上昇はなかった。

Table 3. 各モデルの ROC 曲線下面積(AUROCC)

Predictor variables of each regression model	AUROCC JTDB	AUROCC KKTR
TRISS (USA)	0.9625	0.9628
ISS, RTS, cAY	0.9598	0.9657
ISS, RTS, AY	0.9624	0.9666
ISS, AY, cSBP, cGCS, cRR	0.9624	0.9667
ISS, AY, cSBP, cGCS	0.9617	0.9667

全ての モデルでAUROCCs は 0.95 を超えていた。AY､ISS と RTS のモデルの方が､cAY,､ISS と RTS のモデルより AUROCC が大きかった。

D. 考察

TRISS法の回帰式が導かれた米国のMajor Trauma Outcome Study (MTOS)[2] で認められたように55歳の前後において死亡割合の急激な上昇は､JTDBでもKKTRでも認められなかった。よって年齢に関する予測変数は、カテゴリー化されていない実年齢を使用する方が適切であろう。

我々の以前の研究では[1]、JTDB データ(2004-2007)においてRR 情報は 18.8% で欠損していた。そしてISS, AY, cSBP と cGCSを用いたモデルを利用することにより，TRISS ではPs を求めることができなかった患者データの 38.1% において Ps を算出することが可能となった。そのモデルのAUROCCは、0.923 と十分高かった。

KKTRデータでは、cRRの予測変数を加えても、モデルがほとんど良くならなかった。Table1 では、RR が10-29/min のものが92.1%もあることが（JTDBでは77.9%）その原因であると思われる。

Bouamra ら[5]は、英国において RTS の代わりにGCSのみを用いたモデルを開発し(AUROCC = 0.947）、劇的にデータ欠損による Ps 計算不能を減らすことに成功した。しかしながら、他の予測変数が多くなり、モデルはTRISS より複雑になってしまった。

昨年度の我々の研究では[6]、カテゴリー化されたcISS と cGCS、cSBP のみから、係数が１に簡略化されたモデルを開発しており、JTDB でも KKTR でもAUROCC は 0.95 以上であった。

E. 結論

1) 日本やタイ国では、生存確率予測回帰式の年齢に関する予測変数として、カテゴリー化されたものではなく実年齢を用いるべきである。
2) 日本やタイ国では、回帰式から呼吸数に関する予測変数を省略しても、予測精度はほとんど落ちないし、患者の生存予測も広がる可能性がある。

F. 研究発表

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G. 知的所有権の取得状況

なし

H. 参考文献

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厚生労働科学研究費補助金（地球規模保健課題推進研究事業）

分担研究報告書

わが国の労働安全衛生活動に用いられた教材に関する研究

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研究要旨

わが国の労働安全衛生対策で効果を上げてきた、参加型の実践活動を支援するために作成された教材を翻訳・紹介した。「職場改善のための安全衛生実践マニュアル」から、転落・墜落の予防、機械への巻き込まれ予防、緊急時の手順、職場安全チェックリストを英訳した。今後、このような教材を用いて途上国の産業現場で参加型活動を行い、その効果を評価するべきである。

A. 研究目的

わが国の労働安全衛生対策の特徴の一つとして、企業レベルや組合活動として安全水準の向上を図る活動を行うなど、職場レベルで労使が自主的日常的に職場の健康・安全リスク低減対策を推進する基本的な枠組みが整えられていることがある。参加型の自主的取り組みを通して、自らリスクを発見し改善していく能力を養ってきたことは、わが国における労働安全衛生活動の成功要因の一つである。このような参加型の実践活動を支えている教材を翻訳し紹介した。

B. 研究方法

参加型実践活動を支援するために作成された「職場改善のための安全衛生実践マニュアル」から、途上国の労働災害として重要である、転落・墜落の防止や、機械や設備の安全を考えるためのチェックポイントと、職場の健康問題を包括的にとらえるための「職場安全衛生チェックリスト」を英訳し紹介した。

C. 研究結果

この教材は改善のためのアクションを起こすことを前提として、それぞれの重点的課題についてチェックポイントから始まっており、グループ討論の中で、リスク要因の同定とその改善策を話し合うように作成されている。チェックポイントとして翻訳紹介したのは、転落・墜落の予防、機械の可動部への巻き込まれ予防、緊急時の対処の3点である。

転落・墜落の予防では、危険個所への立ち入りを防止することや、転落防止策を設けることなどを対策として挙げてあり、職場の中で転落・墜落の危険がある個所を見出して、どのような安全策を講じるべきか論じるということが課題となっている。機械の可動部への巻き込まれ防止については、可動部にカバーを付けることが予防策として挙げてあり、職場の中でカバーされていない機械の可動部を指摘して、どのような対策を取るか論じることが課題となっている。緊急時の対処については、トラブル発生時の措置や手順を決めて周知しておくことの重要性を挙げて、職場で起こりうるトラブルと、その際に取るべき処置について議論することが課題となっている。

職場安全衛生チェックリストは、「安全衛生実践マニュアル」にあげたチェックポイントをまとめてリストにしたものである。

D. 考察

参加型活動は自らリスク要因を見出して改善していく能力を身に着けていくものであり、わが国でも効果を上げてきた。このような教材を提供することにより、途上国の産業現場での安全衛生対策を促進することが期待できる。同様の参加型活動の教材は、地域において交通安全対策やそのほかの外傷予防策を参加型活動を通して行う際に有用である。今後、英語から現地語に翻訳して、実際に産業現場での安全衛生活動に活用して効果を確認していく必要がある。

E. 結論

わが国の労働安全衛生活動で効果を上げてきた、参加型実践活動を支援するための教材を翻訳・紹介した。今後、実際にこの教材を用いた活動を行いその効果を確認する。

F. 研究発表

なし

G. 知的所有権の取得状況

なし

H. 参考文献

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資料

Checkpoints for safety in workplace (safety for machinery and equipment)

Checkpoint 1

Install partitions to prevent entry to dangerous areas, and place fencing, etc., to protect people from falling.

Why is this important?

Workplaces have many danger zones, including trash incinerator pits, areas around machinery that radiates high heat, and busy vehicle entrances and exits. The best way of preventing falls, burns, collisions, and other accidents in such zones is not simply to make sure workers do not enter them, but to make it *impossible* for workers to enter them. Partitions and fencing are the most basic ways to achieve this goal.

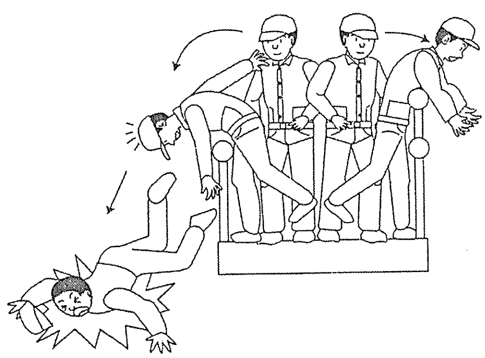

Fig. 1 Improve fall-prevention fencing.

How can we make improvements?

If you surround dangerous areas with partitions and fencing, accidents will not occur because no one can enter them. If workers must enter an area where there is a risk of falls, install handrails or fencing to prevent falls. It is also important to display clear signs indicating risks in dangerous areas. Furthermore, to prepare for the event of a fall, install and regularly inspect rescue equipment. Take the following steps for all dangerous areas in the workplace:

- ☐ Surround dangerous areas with partitions and fencing so that workers cannot enter them.
- ☐ If workers need to enter high places, install handrails or fencing to prevent falls.
- ☐ **Ensure fall-prevention fencing is taller than waist-high.**
- ☐ Place clear signs indicating risks in dangerous areas that workers need to enter.
- ☐ Install rescue equipment in areas where there is a risk of falls.
- ☐ Regularly inspect rescue equipment and keep it ready to use at any time.

Discussion points

- ■ List all the dangerous areas in your workplace.
- ■ Consider whether safety measures have been taken to ensure that workers do not carelessly enter each of those areas.

Checkpoint 2

Attach covers to machinery where there is any danger of hands or clothing getting caught in moving or revolving parts.

Why is this important?

Make sure that hands and clothing do not touch moving or revolving machine parts under any circumstances. This requires protective covers or safety devices that stop the machine when hands are in a dangerous position. However, such covers and safety devices must not interfere with work or reduce efficiency, because workers are bound to remove them if they are annoying.

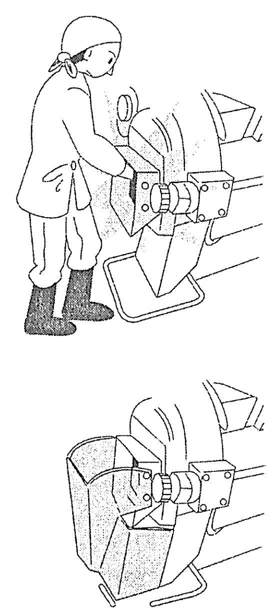

Fig. 2 Cover dangerous machine parts.

How can we make improvements?

Take the following steps to ensure that machinery and equipment are safe:

- ☐ **Install covers on moving or revolving machine parts to prevent hands and feet from getting caught.**

☐ Hands, hair, and clothing are particularly prone to getting caught in moving parts such as gears, pulleys, chains, and belts, and this can cause serious accidents. Install safety covers over such parts.

☐ Mechanize operations that require materials to be inserted in, or supported by hand near, moving machine parts.

☐ Install safety devices that stop machinery if hands or feet are in a dangerous position.

☐ Introduce a system that prevents the machine from operating unless safety devices such as covers and gates are closed.

☐ Equip machines with two "on" switches that will not work unless pressed with both hands at the same time.

☐ Ensure safety devices do not interfere with work or reduce efficiency.

☐ Install safety devices in a manner that precludes operators from removing them.

☐ Configure safety devices so that operators cannot switch them off.

Discussion points

- List all the "nip points" where operators could get caught in machines in your workplace.
- Give one or more examples of safety measures taken regarding dangerous parts of machines in your workplace.

Checkpoint 3

Ensure that all workers are aware of safety procedures to be taken in the event of problems or emergencies, and that necessary instructions are displayed in the required places.

Why is this important?

It is essential to know what procedures to follow when problems occur with machinery or equipment. Depending on the problem, taking the wrong steps could lead to a serious accident. Even if this is not the case, swift and appropriate action is required. Since there is no time to look through manuals when an emergency occurs, workers need prior and thorough knowledge of what steps they should take and in what order they should take them.

How can we make improvements?

List and publicize procedures to be taken when problems or emergencies occur, starting with the most important items. **Clear instructions that can be referred to in an emergency are also required.** For especially important matters, it is best if workers nearby machinery or equipment also know what procedures to take by looking at the instructions. This advice does not apply only to serious problems. For example, think about small everyday problems such as how to remove materials that are stuck in a machine. There are many real-life examples of people getting their hands caught because they tried to grab materials without stopping the machine. Safety procedures should be determined in advance even for such small problems: first stop the machine and lock the switch in the "off" position, then use a tool to remove the material.

Take the following steps:

☐ Give specific examples of possible problems with individual machines and equipment.

☐ Decide clear safety procedures to be taken when specific problems occur.

☐ Train all operators using the relevant machines to take these procedures, and check they can actually do so.

☐ Display clear written instructions for safety procedures next to the relevant machines and equipment.

☐ Ensure nearby workers can also follow the procedures by looking at the instructions.

☐ **Install emergency switches to stop machinery if hands or clothing get caught.**

☐ Place emergency-stop switches where they can be reached even if the operator has had an accident and cannot move.

☐ Use distinctive colors to make emergency-stop switches easy to see.

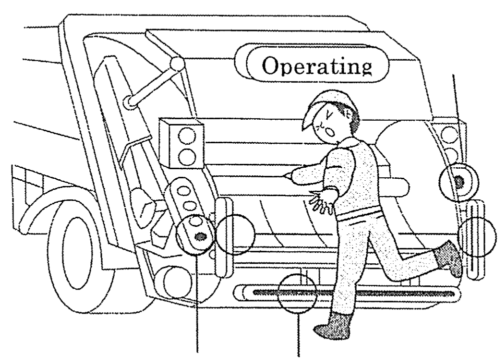

Fig. 3 Install emergency-stop switches on machinery if there is a risk of the operator getting caught.

If an emergency-stop switch is placed only to the left of the trash chute on this compactor truck, the operator may not be able to reach it if he gets caught in the mechanism. This example shows a similar switch installed on the right, and bumper-type emergency-stop bars. Even if the operator gets caught, he can stop the machinery by striking the switch covers with his foot or knee.

Discussion points

- List three problems that could occur with machines or equipment you use in the workplace.
- Describe procedures that should be followed to address each of these problems.

Workplace Health and Safety: Action Checklist

Workplace Health Issues

1. Request workers to give three or more examples of improvements made so far (or in the previous fiscal year) for the sake of workers' health.

   This action is: ☐ not required ☐ required ⟶ ☐ high priority

2. Invite workers to give three or more examples of health problems in the workplace, and discuss as a group the relationship of these problems to work.

   This action is: ☐ not required ☐ required ⟶ ☐ high priority

3. Encourage workers to give two or more examples of health issues they would like to see addressed now (or in this fiscal year).

   This action is: ☐ not required ☐ required ⟶ ☐ high priority

4. Have workers identify three or more examples of difficult working conditions in the workplace (in terms of tasks or working environment).

   This action is: ☐ not required ☐ required ⟶ ☐ high priority

5. Ask workers to list and discuss common health complaints in the workplace.

   This action is: ☐ not required ☐ required ⟶ ☐ high priority

6. Have workers identify health problems that have been addressed using the results of health checkups to date (or in the previous fiscal year), and discuss how these results should be utilized.

   This action is: ☐ not required ☐ required ⟶ ☐ high priority

7. Create forums for discussing health problems between workers and managers.

   This action is: ☐ not required ☐ required ⟶ ☐ high priority

8. Ask workers to list health problems at the workplace to be addressed as a priority in this fiscal year.

   This action is: ☐ not required ☐ required ⟶ ☐ high priority

9. Create more forums for discussing specific measures to resolve workplace health and safety issues.

   This action is: ☐ not required ☐ required ⟶ ☐ high priority

Safe Equipment and Machinery

10. Ensure clear routes for safe transport and movement of goods in the workplace.

    This action is: ☐ not required ☐ required ⟶ ☐ high priority

11. Ensure that machinery, equipment, and work areas are safe and worker-friendly.

    This action is: ☐ not required ☐ required ⟶ ☐ high priority

12. Install partitions to prevent entry to dangerous areas, and place fencing, etc., to protect people from falling.

    This action is: ☐ not required ☐ required ⟶ ☐ high priority

13. Ensure there are at least two emergency exits with clear signs on each floor and in each large room.

    This action is: ☐ not required ☐ required ⟶ ☐ high priority

14. Attach covers to machinery where there is any danger of hands or clothing getting caught in moving or revolving parts.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

15. Ensure the safety of electrical facilities by completely covering any electrical or high-temperature parts of machinery or equipment.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

16. Conduct regular maintenance and checks of machinery and equipment.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

17. Ensure that all workers are aware of safety procedures to be taken in the event of problems or emergencies, and that necessary instructions are displayed in the required places.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

18. When machinery and equipment is being introduced or upgraded, create a forum for hearing and reflecting views from the workplace.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

19. Conduct thorough training on operating newly introduced or upgraded machinery and equipment.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

20. Have a workplace discussion on machinery and equipment to be introduced or upgraded, and ensure that the outcome of discussion is reflected in actual plans.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

Workplace Temperature, Lighting, and Noise

21. Ensure natural ventilation by using air flow from windows, doors, extractor fans, etc.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

22. Install air conditioning and ventilation equipment that can be adjusted by workers according to the type of work they are doing.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

23. Shield workers from heat sources by surrounding high heat sources with insulation or using partitions to prevent radiant heat.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

24. Provide proper work clothes, gloves, etc., to protect workers from cold and rain.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

25. In accordance with the type of work being conducted, ensure good overall lighting using natural light sources, and install spot lighting where necessary.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

26. Prevent unpleasant glare, for example, by changing the layout of the work area, altering the position of light fittings, or installing partitions.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

27. Conduct regular maintenance and checks of light fittings and windows that let in light.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

28. Use quieter machines or place noisy machines well away from workers.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

29. Surround noisy machines with noise insulation materials or take other noise prevention measures.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

30. When work must unavoidably be carried out in highly noisy environments, use earplugs or earmuffs as appropriate.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

Handling of Hazardous and Infectious Substances

31. Attach warning labels to all hazardous substance containers, including replacement containers.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

32. Ensure that safety data sheets for hazardous substances used in the workplace are available and freely accessible to all workers and that they know where the sheets are stored.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

33. Display hazard information and emergency procedures for key hazardous substances in an appropriate place.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

34. Establish handling criteria for hazardous and infectious substances and ensure these are known to all workers.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

35. Wherever possible, enclose or isolate machinery and equipment that uses hazardous substances.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

36. Install local ventilation in work areas or improve existing local ventilation equipment.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

37. Determine safe disposal methods for hazardous and infectious substances, and ensure they are strictly adhered to.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

38. Provide workers handling hazardous or infectious substances with protective work clothing, and ensure a storage area is available for such clothing.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

39. Provide workers who must unavoidably come into contact with hazardous or infectious substances with safe and appropriate protective equipment, and train them to use it.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

40. Install emergency eye-washing, hand-washing, and shower facilities near the work area.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

41. Determine emergency safety procedures and post-emergency measures, and ensure these are known to all workers.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

Ergonomics

42. Install multilevel storage for materials, tools, documents, etc.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

43. Ensure sufficient handcarts are available for transporting goods.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

44. Provide a materials trolley on casters next to the work area.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

45. Use lifting equipment to raise and lower heavy objects.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

46. Adjust work surfaces to around elbow height.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

47. Place materials and tools within easy reach.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

48. Use fixtures effectively so that it is easy to hold objects being worked on.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

49. Use height-adjustable chairs and ensure sufficient legroom.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

50. Place concise and pertinent work instructions where they can be easily read from work areas.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

51. Ensure that materials trolleys, switches, and levers are easily distinguishable by color and shape.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

52. Place clear labels on switches that are easily confused.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

53. Change to easy-grip tools and handles.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

54. Ensure that emergency stop switches on machinery and power tools are quickly identifiable by color and shape.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

55. Automate or mechanize repetitive strenuous tasks, or mix them with other tasks.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

Organizing Tasks and Alleviating Stress

56. Ask workers to give two or more examples of measures to reduce long working hours or excessive overtime.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

57. Have workers identify two or more examples of incremental efforts to address insufficient breaks in the work day or between shifts caused by irregular work, busy periods, or shift work, and create an opportunity to discuss these in the workplace.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

58. Examine actual annual working hours and days of leave taken, propose two or more possible measures for shortening working hours or increasing holidays, and discuss workplace cooperation to achieve these ends.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

59. Ask workers to give two or more examples of support that can be provided now in the workplace to improve stressful tasks such as intensive, monotonous, and isolated work.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

60. Encourage workers to give examples of improvements in the length and timing of breaks, including meal, rest, and tea breaks.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

61. Have workers identify two or more examples of steps that can be taken immediately to improve workplace communications, and create a forum for discussing these that includes managers.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

62. Install or improve break areas/rooms and make sure they are comfortable and suited to relaxation and refreshment.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

63. Invite workers to give examples of measures that can be taken now to ensure clean and pleasant restrooms, washing facilities, shower rooms, and locker rooms.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

64. Ask workers to give examples of improvements that can be made to ensure facilities for drinking water, coffee, tea, and other beverages, as well as clean and comfortable eating areas.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

65. Have workers identify examples of improvements that can quickly be made to facilities required for sports, workouts, or voluntary club activities, and discuss how these can be implemented.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

Everyday Health and Safety Activities

66. Hold regular meetings of the Health and Safety Committee or similar forum.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

67. Discuss examples of work accidents and occupational illnesses and consider preventive measures in the Health and Safety Committee or similar forum.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

68. Discuss priority health and safety measures and progress with implementation in the Health and Safety Committee or similar forum.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

69. Regularly conduct joint management-labor workplace inspection tours.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

70. Hold a group discussion each time the outcome of a workplace inspection tour is announced and propose necessary measures.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

71. Hold workplace discussions on ways of contributing to the local environment and implement proposals.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

72. Organize and implement health and safety circle activities in cooperation with the Health and Safety Committee or similar forum.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

73. Create a forum for sharing inspection tour outcomes and workplace improvement experiences.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

74. Address health issues that continue to require resolution, seeking advice from occupational health staff and labor unions.

This action is: ☐ not required ☐ required ⟶ ☐ high priority

研究成果の刊行に関する一覧表

雑誌

発表者氏名	論文タイトル名	発表誌名	巻号	ページ	出版年
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木村昭夫	我が国における鈍的外傷患者の生存予測ロジスティック回帰式の検討:第2報	日外傷会誌	24(3)	321-326	2010
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Lessons learnt from the recent tsunami in Japan: necessity of epidemiological evidence to strengthen community-based preparation and emergency response plans

Shinji Nakahara

A massive tsunami following an earthquake of magnitude 9.0 hit the northeastern part of Japan on 11 March 2011, causing catastrophic damage in coastal areas of the country. The death toll may have exceeded 20 000, with most deaths having been caused by drowning. As of 4 September, the National Police Agency has confirmed 15 763 deaths and has reported 4282 persons as missing.[1–3] This tragedy implies a partial failure of Japan's long-term efforts on preparation and emergency response plans for its frequent earthquakes and tsunamis. Having frequently sustained devastating tsunami damage in the past, the severely damaged areas, particularly the Sanriku coast in the northern part of the affected region, were well equipped with extensive coastal defences and sophisticated tsunami warning systems.[4 5] These technology-oriented measures, however, could not provide effective protection against this once-in-a-millennium tsunami.

This failure propelled Japanese authorities to recognise their over-reliance on technical solutions in their current approaches to disaster mitigation and to make a shift to more balanced solutions, which assume technological limitations and put greater emphasis on evacuation and land use.[4 6 7] The alternative approaches aim to promote community-based efforts in developing detailed evacuation plans and in targeting aspects of residents' behaviour. Epidemiological data, such as geographical and demographic risk distribution, should be used to guide such measures. The health sector and injury control experts should contribute in this regard by collecting and analysing epidemiological data. However, currently in northeastern Japan, preventing post-disaster health problems is a more pressing issue.

Before the 2011 tsunami, Japan's disaster countermeasures had made continual progress by reducing risk factors when weaknesses became apparent during natural disasters. However, the tsunami on 11 March 2011 exposed major limitations in Japan's emergency response plan for tsunamis. This paper provides an overview of Japan's experience in developing disaster preparation plans—an experience founded on lessons learnt in the past. It discusses what brought about the flaws revealed recently and what we can do to reduce casualties in any future disasters, with a focus on community-based actions founded on a better understanding of epidemiological evidence.

JAPAN'S EXPERIENCE OF EARTHQUAKES AND COUNTERMEASURES

Japan has experienced severe damage from frequent earthquakes, either directly from tremors or indirectly from tsunamis; lessons learnt from the damage have guided the subsequent development and improvement of countermeasures. The Great Kanto Earthquake on 1 September 1923 claimed approximately 105 000 lives in the Kanto area (mainly Tokyo, Kanagawa and the Chiba Prefecture). Of the total deaths, about 92 000 (87%) were caused by fire and about 11 000 (11%) were caused by collapsing houses.[8 9] Many fires broke out after the tremor because the earthquake occurred at 11:58, when many people were preparing lunch using charcoal stoves and more than 100 000 houses, mainly built of wood, collapsed. Unfortunately, a strong wind of more than 15 metres per second that afternoon assisted the rapid spreading of the fires. After the Great Kanto Earthquake, various measures were brought into effect to reduce fire-related casualties caused by earthquakes: better urban planning was introduced, with wider roads and larger green areas to prevent fire from spreading in city centres; charcoal stoves were replaced with safer gas cooking stoves; and the quake-resistance and fire-resistance of buildings were improved.[8 10 11]

In the Great Hanshin–Awaji Earthquake of 17 January 1995, in contrast, the leading causes of death were asphyxia/compression (77%), head/neck injuries (5%) and other traumatic injuries (4%), which were mainly caused by collapsing buildings or falling furniture. Fire accounted for 9% of the deaths; many of the fire victims were unable to escape from collapsed buildings.[12 13] Since the earthquake occurred at 05:46, when most people were asleep, the great majority of casualties occurred indoors. The lower proportion of deaths due to fire may have resulted of the fact that relatively few people were cooking at the time, in addition to the effects of the measures introduced after the Great Kanto Earthquake. Also, there were no strong winds that day.

Although efforts to improve quake and fire resistance in buildings were made for quite some time, those improvements were insufficient at the time of the Great Hanshin–Awaji Earthquake. The Japanese government introduced a building code in 1950 and tightened quake-resistance standards in 1981, however, there was still a large number of old buildings that had been constructed before 1981, and these accounted for the majority of collapsed structures in the earthquake.[14] To facilitate the renovation of old buildings after the earthquake, the government introduced the Act for Promotion of Renovation for Earthquake-Resistant Structures in 1995, which stipulates mandatory renovation of buildings for public use. However, renovations of private residences, which this law does not address, have still been executed insufficiently.[14]

The Sanriku area has frequently sustained earthquake damage, mainly as a result of tsunamis. The most severe one was the Meiji Sanriku Earthquake on 15 June 1896. Although the tremor itself was relatively weak in inhabited areas, it was followed by a huge tsunami, with

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-132-

a greatest run-up height of 38.2 metres, causing over 22 000 deaths.[5 15] On 3 March 1933, another earthquake struck the same region, followed by a tsunami with a maximum run-up height of 23.0 metres, resulting in about 3000 deaths. The strong tremors prompted the residents to evacuate the area, thereby minimising human casualties. Subsequent countermeasures to mitigate the impact of tsunamis have included a tsunami warning system, which was used first in this area in 1941 and was expanded to the whole country in 1952, the construction of breakwaters and seawalls, and relocating residential areas to higher grounds.[5 16] In 1958, the Sanriku town of Taro constructed a huge 10 metres high and 2.5 kilometres long seawall, which was nicknamed the Great Wall. These measures were based on geographical risk distribution and targeted areas that had been severely affected in past disasters.

On 24 May 1960, an earthquake off the Chilean coast caused a tsunami in the Sanriku area, thus revealing a weakness in the warning system which did not cover such distant events. The tsunami resulted in severe damage and 142 deaths, due in part to the lack of palpable tremor warning signs.[5 16] In contrast, Taro's Great Wall offered local protection from this tsunami, while other areas with smaller structures sustained great damage. The government consequently initiated a 5-year plan to develop seawalls and breakwaters in the Sanriku area, and expanded the tsunami warning system to cover distant events.

Consequently, the Sanriku coastline became a showcase of Japan's advanced technology in civil engineering—for example, the world's deepest tsunami breakwater at Kamaishi Bay in the Iwate Prefecture. Since the completion of the 5-year plan in 1966, the gigantic coastal defences successfully protected the areas from frequent tsunamis until 11 March 2011. This temporary success, possibly coupled with the extensive defences' reassuring appearance, may have provided residents with a false sense of safety against tsunamis[4] and deterred them from evacuating promptly. Several surveys reported that, in recent earthquakes, most residents in these areas did not evacuate even when tsunami warnings were issued.[17 18]

Although the Japanese government—as stated in its 1998[19] guidelines on enhancing tsunami countermeasures—has endorsed comprehensive countermeasures, including evacuation planning, land use and protection works, its approach was greatly biased towards technology-oriented measures. This is partly because of the relative success of coastal defences and also because of the long and difficult process of obtaining a consensus among residents in order to modify land use. Although municipal governments were obliged to designate and manage evacuation sites, the educational and behavioural aspects of evacuation were left to the local communities. The degree of community-based activities such as safety education and evacuation drills varied greatly across communities, depending on the perceptions and dedication of the community. In some communities, participation in evacuation drills was much less than satisfactory, whereas in others, safety education and drills, particularly at schools, were carried out regularly.[18 20] Such differences in community-based preparedness may have had life-and-death consequences in the tsunami on 11 March, as described below.

LESSONS FROM THE TSUNAMI ON 11 MARCH 2011

The unexpectedly massive tsunami on 11 March 2011 overwhelmed all coastal defences in northeastern Japan and caused devastation over vast areas. Collapsed buildings due to the tremor were minimal and most of the casualties were the result of the tsunami.[2] The lessons learnt are twofold. First, prediction-based technology-oriented measures may fail because we cannot predict accurately the maximum magnitude of future natural disasters. The height of the tsunami was far greater than the predictions used in designing seawalls and breakwaters.[2] Although corrected later, the initial tsunami warning underestimated the actual tsunami's height, which possibly affected people's evacuation behaviour. The information network of the tsunami warning system did not work as expected in some areas because of the destruction caused by the tremor or electrical failures.[2 21] Furthermore, the tsunami struck areas outside the potential danger zones indicated on hazard maps, underlining the inaccuracy of the predictions. In addition, people (particularly those outside the designated danger zones) may not have evacuated promptly after the earthquake despite calls to do so because of the false sense of security provided by the extensive coastal defences and the initial failure of the warning system.

Second, community-based preparedness could save lives despite the failure of coastal defences and the warning system. Well-prepared evacuation planning through regular drills led to the prompt evacuation (immediately after the earthquake) of some locals who did not wait for evacuation calls. Examples of such good practices include the successful evacuation of schoolchildren in Kamaishi; as they had been regularly trained and rushed to the designated spot on higher grounds immediately after the tremor, and all survived even though the tsunami engulfed the school.[20] In contrast, at a school in another city in the northern part of the Miyagi Prefecture that did not have a designated evacuation site, the teachers discussed possible evacuation sites only after the quake, thereby delaying the evacuation and the tsunami engulfed the children as they were evacuating.[22]

Future tsunami preparation and emergency response plans should incorporate such experiences. An expert panel to the Central Disaster Prevention Council recently issued an interim report on future countermeasures. It pointed out the limitations of previous approaches, which relied mainly on prediction-based technology-oriented solutions and it stressed the necessity of putting greater priority on residents' evacuation planning and land use.[6 7] This is a clear transition from the previous approach to a more balanced approach, involving comprehensive measures that incorporate land use and evacuation plans. Such comprehensive measures to facilitate immediate evacuation are crucial in preparing for a once-in-a-millennium tsunami because it is not feasible to predict accurately the maximum possible magnitude of tsunamis, even though predictions are useful in the protection against such tsunamis. This approach is actually a return to the basic principle stated in the government's previous guidelines, which emphasised the importance of three components: coastal defences, evacuation planning and land use. Necessary measures include the designation of evacuation sites and routes, high-rise reinforced concrete buildings to be considered as evacuation sites in lowland areas that are far from higher ground,[23 24] regular evacuation drills, safety education for residents so that they can undertake immediate evacuation after an earthquake or evacuation call, careful evacuation plans for vulnerable groups and changing land use in areas at extremely high risk of damage (eg, relocating residential areas to higher grounds).

RESEARCH AGENDA

A better understanding of health issues during and after disasters based on

-133-

geographical, demographic, communal and architectural characteristics would provide information that is useful for developing better disaster mitigation plans and post-disaster management.[25] The health sector should play a variety of roles in disaster situations, including the dispatching of disaster medical assistant teams, healthcare activities in shelters ranging from prevention of infectious diseases to management of chronic diseases and long-term care for mental health problems in the affected areas. Epidemiological data from previous disasters can guide these activities. Previous experience of earthquakes reveals the need for wide-area transportation between the affected zone and outside areas for a large number of trauma victims, as well as for the management of chronic diseases and mental health problems—all of which are issues that tend to be aggravated in disaster-affected areas.[26 27] The lessons learnt after the tsunami on 11 March 2011 will improve the post-disaster responses by the health sector: unlike in previous massive earthquakes, there were few severely injured victims and healthcare needs for chronic diseases were far greater than those for acute care, even in the early stages.[28] The attention of healthcare personnel is currently focused on monitoring post-disaster morbidity, particularly because of the explosions that occurred at the Fukushima power station.[29 30]

However, we should also pay attention to the necessity of learning from this terrible disaster for the primary prevention of future tsunami-related casualties. Identifying vulnerable groups may lead to customised evacuation plans. Environmental risk factors, such as distance or routes to evacuation sites, may be modified by designating safe high-rise building as evacuation sites or by installing special roads to higher grounds. Putting such knowledge into practice would require collaboration in such areas as health science, behavioural science, social science, civil engineering, architecture and urban planning.

Although disaster epidemiology is still in its infancy, several studies have examined casualty patterns in earthquakes and have identified risk factors: being inside a building during the earthquake; location within the upper floors of a building; building type, height and construction materials of buildings; being unmarried, female, elderly or physically disabled; and health status.[31–34] A study on the Great Hanshin–Awaji Earthquake revealed that old age and physical disability increased the risk of death; physical disability particularly increased the risk when dwellings were not completely destroyed, suggesting that the ability to escape from a collapsed building is related to survival chances.[35] Epidemiological studies on tsunamis, although limited, indicated an increased risk of death in the Indian Ocean tsunami in 2004 among the following groups or factors: children, elderly people, women; living on flat, low land; being indoors or being out fishing at the time of the tsunami.[36–38]

So far, no such epidemiological studies have been carried out with regard to the tsunami in Japan on 11 March 2011. In fact, only anecdotal information is available and the Japanese government has reported summary figures based on police data. As of 11 April 2011, among the 13 135 confirmed deaths in the three most affected prefectures, 92.5% were by drowning and 65.2% of those who died were aged 60 years and over.[2 3] These figures clearly indicate the necessity of investigating why elderly people are a vulnerable group. To improve preparedness for future disasters, we need to answer the following questions (this list may not be exhaustive): Who were the vulnerable groups? What structures (buildings and coastal defences) did/did not play their protective roles? Who did/did not evacuate the disaster-affected zones? What facilitated/impeded prompt evacuation? What behaviour increased/decreased the risk of injuries? What preparation and emergency response plans were effective/ineffective in preventing injuries? What environmental factors had protective/harmful effects?

CONCLUSIONS

This paper describes how Japan, having learnt from its past experience, has improved its countermeasures against earthquakes and tsunamis, however, it also indicates that there is still much to be improved on. Extensive coastal defences provided good protection against once-in-a-decade tsunamis with predictable magnitudes. However, the failure of such prediction-based technology-oriented tsunami countermeasures during the tsunami on 11 March 2011 has urged us to return to the basic principles in developing comprehensive measures. Given that the maximum possible magnitude of tsunamis cannot be predicted accurately, protection for all by means of coastal defences is not possible. This obliges us to develop better evacuation plans with safety education and drills. Epidemiological studies analysing the data from the tsunami that took place on 11 March 2011 will surely make a strong contribution to such planning efforts. Japan's experience in developing comprehensive countermeasures will also benefit other countries that suffer from frequent earthquakes and tsunamis. In countries where constructing huge coastal defences is not feasible, evacuation plans, behavioural approaches through safety education and drills, and prompt warning systems are of particular importance.

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Man charged after stepson shot teenager

Police in British Columbia allege a 10-year-old boy accidentally shot and killed a teenager. Charges of criminal negligence and careless storage of a firearm are being laid against the boy's stepfather. The boy unintentionally discharged a shotgun that killed a 17-year-old friend. The Royal Canadian Mounted Police said that such incidents are rare, but completely preventable, noting that the boy's access to the gun was 'unimpeded'. Ed note: *This stands in sharp contrast to experience elsewhere and it is worth stressing that the RCMP seized **numerous** firearms from the home.* http://www.theglobeandmail.com/news/national/british-columbia/bc-man-charged-after-10-year-old-stepson-shot-teen-dead/article2190786/

-135-

原　著

ICDとAISへ変換可能な新たな外傷分類の作成

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外傷の診断分類は，診療記録あるいは診療報酬請求といった診療情報管理に国際疾病分類（International Classification of Diseases and Related Health Problems：ICD），解剖学的重症度を必要とする外傷登録にAbbreviated Injury Scale（AIS）と，目的別に2通りの方法が使い分けられることが多い．両者間の直接変換は困難であるため，中間的な新分類からICDとAISに変換するという方法を考案した．単一コード使用というICDの制約は外し，ICDとAISで分類粒度が異なる場合には細かい分類を採用し，四肢の例でみられる分類境界が異なる場合にはすべての境界を使用することで，新分類からICDおよびAISへの一義的変換を可能にした．これにより二重コーディングの負担解消と，外傷登録を利用した診療の質評価・改善の活発化が期待できる．

索引用語：外傷診断分類，国際疾病分類，AIS，外傷登録

Abbreviations

International Classification of Diseases and Related Health Problems：ICD
ICD based injury severity score：ICISS
ICD clinical modification：ICD-CM
Abbreviated Injury Scale：AIS
Injury Severity Score：ISS
Trauma and Injury Severity Score：TRISS
Diagnosis Procedure Combination：DPC

緒　言

外傷の診断分類として，診療記録あるいは診療報酬請求といった診療情報管理には疾病および関連保健問題の国際統計分類（国際疾病分類，International Classification of Diseases and Related Health Problems：ICD），解剖学的重症度を必要とする外傷登録にはAbbreviated Injury Scale（AIS）と，目的別に2通りの方法が使い分けられることが多い[1)-4)]．両者間の変換が容易であればこのような二重コーディングを避けられるのだが，ICDは単一コードにより死亡原因を分類し，AISは複数コードにより解剖学的重症度を記述するという，成り立ちと使用原則の違いから，直接変換は困難であった[1)5)]．

本研究では両者の中間的な新分類を作成し，新分類からICDとAISに変換するという方法を考案した．

方　法

上記の，ICDとAIS相互の変換における問題点の多くは，分類の粒度が双方で異なること，解剖学的分類の境界が違うことに起因する．粒度が粗い分類から細かい分類への変換（分割）には追加の詳細情報を診療記録や画像情報から得る必要が生じるため，自動変換は不可能である．粒度の細かい分類から粗い分類への変換（集約）は自動的に行いうるが，ICDからAIS，AISからICDのどちらの変換方向であっても，分割を伴う変換が生じる．全般的にAISの分類粒度（特に損傷性

Table 1　The new classification system bridging differences in anatomical classification between ICD and AIS

ICD	New classification	AIS
Upper extremity		
S4x Shoulder/upper arm	Shoulder	Shoulder
	Upper arm	Upper arm/elbow
S5x Elbow/forearm	Elbow	
	Forearm	Forearm/wrist
S6x Wrist/hand	Wrist	
	Hand	Hand
Lower extremity		
S7x Hip/thigh	Hip	Hip
	Thigh	Thigh/knee
S8x Knee/lower leg	Knee	
	Lower leg	Lower leg/ankle
S9x Ankle/foot	Ankle	
	Foot	Foot

ICD, International Classification of Diseases and Related Health Problems ; AIS, Abbreviated Injury Scale

状分類）の方が細かいが，一部ICDの粒度の方（解剖学的分類）が細かい．分類境界の相違は四肢の解剖学的分類で顕著である．例えば，ICDで上肢は肩と上腕，肘と前腕，手首と手に3分類されるのに対し，AISでは肩，上腕と肘，前腕と手首，手に4分類される．AISで上腕と肘の外傷と分類されたものをICDに変換しようとすると，正確な受傷部位情報（上腕のみ，肘のみ，あるいは両方）を得る必要が出てくる．

そこで，本研究においてはICDとAIS間の直接変換ではなく，ICD，AIS分類とは別の新分類を作成し，新分類コードからICDあるいはAISに変換するという方法を取った．ICDとAISのコードには，ICD-10のS00-S99とAIS2008の1xxxxxから8xxxxxまでを用いた．ICDとAISで分類の粒度が異なる場合，新分類にはより細かい分類を採用し，全体として分類粒度を均一化した．解剖学的分類の境界が異なる場合には，両者の境界を併用してより細かい分類とした．どちらか一方に対応する分類が存在しない（その他または詳細不明）場合は，存在する方の分類を用いるとともに，損傷性状分類については類似の外傷コードを援用した．また，新分類では多発外傷はAIS同様にそれぞれの外傷にコードを与えることとし，ICDにおける同一部位の多発外傷を示すコードSxx.7および，複数部位の多発外傷を示すコードT00-T07は変換表には含めていない．多発外傷の場合には，各損傷の新分類コードからICDコードに変換した後に，多発外傷コードに変換する．また，受傷部位詳細不明（ICDのT08-T14，AISの9xxxxx）および非外傷（AISの0xxxxx）は除外した．

結　果

Table 1に，ICDとAISの分類境界が異なる場合の例として四肢の解剖学的分類を示す．新分類では，上腕，肘，前腕，手首，手のように細かく分類した．下肢も臀部，大腿，膝，下腿，足首，足に分類した．これにより，新分類からICDとAISへの変換が一義的に決まる．Table 2に新分類の一例として肩～肘の刺創分類を示す．AISでは肘と上腕が同一部位に含まれるため，716014～716017が上腕と肘に分割される．ただし，AIS2008コードではlocalizerをドット以下2～5桁目につけて，ICDと解剖学的分類を一致させることは可能（61が上腕，62が肘，63が前腕）である．新分類における損傷性状分類は，より粒度の細かいAISのものを採用した．Table 2では刺創以外の開放創は省略した．

Table 2 Classification of penetrating injury of the upper arm（from shoulder to elbow）

ICD	New classification	AIS*
S41.0 Open wound of shoulder	Penetrating injury of upper arm, NFS as to severity	716010.1 Penetrating injury at shoulder, NFS as to severity
	superficial ; minor	716011.1 superficial ; minor
	with tissue loss＞25cm²	716012.2 with tissue loss＞25cm²
	with blood loss＞20% by volume	716013.3 with blood loss＞20% by volume
S41.1 Open wound of upper arm	Penetrating injury of upper arm, NFS as to severity	716014.1xx61 Penetrating injury at or above elbow, below shoulder, NFS as to severity
	superficial ; minor	716015.1 xx61 superficial ; minor
	with tissue loss＞25cm²	716016.2 xx61 with tissue loss＞25cm²
	with blood loss＞20% by volume	716017.3 xx61 with blood loss＞20% by volume
S51.0 Open wound of elbow	Penetrating injury of elbow, NFS as to severity	716014.1xx62 Penetrating injury at or above elbow, below shoulder, NFS as to severity
	superficial ; minor	716015.1xx62 superficial ; minor
	with tissue loss＞25cm²	716016.2xx62 with tissue loss＞25cm²
	with blood loss＞20% by volume	716017.3xx62 with blood loss＞20% by volume
S51.8 Open wound of other parts of forearm	Penetrating injury of forearm, NFS as to severity	716018.1xx63 Penetrating injury below elbow, at or above wrist, NFS as to severity
	superficial ; minor	716019.1xx63 superficial ; minor
	with tissue loss＞25cm²	716020.2xx63 with tissue loss＞25cm²

ICD, International Classification of Diseases and Related Health Problems ; AIS, Abbreviated Injury Scale ; NSF, not further specified
*The first localizer（L1）and second localizer（L2）can follow the post-dot severity score. Both L1 and L2 are two-digit numbers : L1 indicates the side and aspect of an injury location and L2 indicates further specificity（e.g., 61 indicates upper arm, 62 elbow and 63 forearm）.

Table 3に上腕の神経損傷分類の一部を示す．正中神経と橈骨神経については，AISの損傷性状分類を採用した．腋窩神経損傷はAISでは詳細不明の神経損傷（730099.9），ICDではS44.3と単一の分類となるが，粒度を均一化するため他の神経損傷と同様の分類を採用した．その結果，他の神経損傷と同様の重症度スコア（カッコ内）を当てはめることも可能となる．

原則として同一部位の多発外傷を示すICDの多発外傷コード（Sxx.7）は削除し，それぞれの