BLS 2113 DA-CPR instruction

Table 2a: Advanced Dispatcher Training

Study	Study Design	Sample	Primary Outcome	Main Findings
Harjanto 2016	Before/After; intervention	2968	Survival to hospital admission, survival neurologically intact at 30 days	Bystander CPR rates increased from 22.4% to 42.1% (p < 0.001) with odds ratio of 2.52 (95% confidence interval [CI]: 2.09–3.04) and ROSC increased significantly from 26.5% to 31.2% (p = 0.02) with OR of 1.26 (95%CI: 1.04–1.53) after the comprehensive DACPR training program intervention. Significantly higher survival at 30 days was observed for patients who received bystander CPR from a trained person as compared to no BCPR (p = 0.001, OR = 2.07 [95%CI: 1.41–3.02]) and DACPR (p = 0.04, OR = 0.30 [95%CI: 0.04–2.18]).
Park 2022	Before/ after registry study	10127	Survival to hospital discharge	OHCA patients in the intervention group were less likely to receive bystander cardiopulmonary resuscitation (57.8% vs 61.1%; P = .02) and showed lower survival outcomes (5.7% vs 6.4% for survival up to hospital discharge; P = .34 and 2.8% vs 3.7% for good neurological recovery; P = .11), but this was not statistically significant. Compared to 2014, good neurological recovery in 2017 was significantly improved in the intervention group (Difference-in-difference (DID) for good neurological recovery = 3.2%; 0.6–5.8). There were no statistically significant differences in return of spontaneous circulation and survival up to hospital discharge between the 2 groups (DID for survival to discharge was 1.8% [1.7 to 5.3] and DID for return of spontaneous circulation was 2.5% [9.8 to 4.8]).
Tsunoyama 2017	Before/After	532	Bystander CPR Initiation	After the program, provision of oral guidance to callers slightly increased from 63% of cases to 69% (P = 0.13) and implementation of chest compression on patients by bystanders significantly increased from 40% to 52% (P = 0.01). Appropriate chest compression also increased from 34% to 47% (P = 0.01). In analysis stratified by the provision of oral guidance, increased chest compressions were observed only under oral guidance.

Table 2b: Centralized Dispatch

Study	Category / Study Design	Sample	Primary Outcome	Main Findings
Lerner 2019	Centralized Dispatch/ Before/After	169	Not defined	Centralizing dispatcher CPR program to serve seven public safety answering points also increased bystander CPR (53%) over previously documented bystander CPR rate (20% the prior year).
Ro 2018	Centralized Dispatch/	11616	Bystander CPR Initiation	OHCAs that occurred after the centralization period were more likely to receive BCPR (62.6%, 50.6% BCPR-with-DA and 12.0% BCPR-without-DA) than were those that occurred before-centralization period

	Before/After; natural experiment			(44.6%, 16.6% BCPR-with-DA and 28.1% BCPR-without-DA) (p < 0.01, adjusted OR: 1.59 (1.38–1.83), adjusted rate difference: 9.1% (5.0–13.2)).

Table 2c: Use of Metronome with DA-CPR

Study	Category / Study design	Sample	Primary Outcome	Main Findings
Lee 2014	Metronome Rates Randomized Mannikin Simulation	78	Compression depth & rate	No significant differences among three different metronome rates (at least 100/min: the metronome rates were 120/min, 110/min, and 100/min in groups 1, 2, and 3, respectively). In all groups, the mean depth of chest compression was less than 5 cm. The mean rates of chest compression were 113.44 ± 12.35/min in group 1, 109.37±2.73/min ingroup 2, and 128.11±16.22/min in group 3. There was a significant difference among groups (P < .001). The mean rate of chest compression of group 1 (120/min) and group 3 (100/min) was higher than that of group 2 (110/min). However, the proportions of compressions between 100 and 120/min were 100.00% (24/24) in group 2, 70.00% (19/24) in group 1, and 25.93% (7/27) in group 3.
Park 2013	Metronome Sound/ Randomized Mannikin Simulation	64	Compression depth & rate	The metronome group showed a faster compression rate than the control group (111.9 vs 96.7/min; p=0.018). A significantly higher proportion of subjects in the MG performed the DA-CPR with an accurate chest compression rate (100–120/min) compared with the subjects in the CG (32/33 (97.0%) vs 5/34 (14.7%); p<0.0001). The mean compression depth was not different between groups (45.9 vs 46.8 mm; p=0.692). However, a higher proportion of subjects in the MG performed shallow compressions (compression depth <38 mm) compared with subjects in the CG (median % was 69.2 vs 15.7; p=0.035).

Table 2d. Change in CPR sequence and ratio.

Study	Category / Study design	Sample	Primary Outcome	Main Findings
Bray 2011	Before/after registry study	3122	Not defined; Bystander CPR Initiation, survival to hospital and hospital discharge	Removal of two initial breaths and introduction of a new compression ratio (from 15:2 to 400 compressions, then 100:2) was associated with rates of bystander CPR increased overall (45–55%, p < 0.001) and by initial rhythm (shockable 55–70%, p < 0.001 and non-shockable 40–46%, p = 0.01). In VF/VT OHCA, there were improvements in the number of patients arriving at hospital with a return of spontaneous circulation (ROSC) (48–56%, p = 0.02) and in survival to hospital discharge (21–29%, p = 0.002), for patients receiving bystander

				CPR. After adjusting for factors associated with survival, the period of time following the change in CPR instructions was a significant predictor of survival to hospital discharge in VF/VT patients (OR 1.57, 95% CI: 1.15–2.20, p = 0.005).

Table 2e: Audiovisual animated instructions

Study	Category / Study Design	Sample	Primary Outcome	Main Findings
Choa 2008	Audio-visual animated video (AA) vs. human Dispatcher (DA) Cluster Randomized Mannikin Simulation	85	CPR Performance Checklist	The AA-CPR group had a significantly better checklist score (p < 0.001) and time to completion of 1 CPR cycle (p < 0.001) than the DA-CPR group. In an objective assessment of psychomotor skill, the AA-CPR group demonstrated more accurate hand positioning (68.8±3.6%, p = 0.033) and compression rate (72.4±3.7%, p = 0.015) than DA-CPR group. However, the accuracy of compression depth (p = 0.400), ventilation volume (p = 0.977) and flow rate (p = 0.627) were below 30% in both groups.

Table 2f. Pre-recorded instruction audio

Study	Category / Study Design	Sample	Primary Outcome	Main Findings
Birkun 2018	Randomized Mannikin Simulation	109	Overall CPR performance (checklist)	No significant differences between groups for the overall performance score (5.6±2.2 vs. 5.1±1.9, *P*>0.05) or individual criteria of the CPR performance checklist. The recording-assisted group demonstrated significantly shorter time interval from call receipt to the first compression (86.0±14.3 vs. 91.2±14.2 s, *P*<0.05), higher compression rate (94.9±26.4 vs. 89.1±32.8 min-1) and number of compressions provided (170.2±48.0 vs. 156.2±60.7).

Table 2g: Implementation of a Novel or Standardized Protocol

Study	Study Design	Sample	Primary Outcome	Main Findings
Stipulante 2014	Before/After	223	Time from call to first compression	Before and after the ALERT protocol implementation (2009 and 2011). In 2009, only 9.9% victims benefited from bystander CPR, this increased to 22.5% in 2011 (p < 0.0002). The main reasons for protocol underutilization were: assistance not offered by the dispatcher (42.3%) and caller physically remote from the victim (20.6%). Median time from call to first compression, defined as no flow time, was 253 s in 2009 and 168 s in 2011 (NS). Ten victims were admitted to hospital after ROSC in 2009 and 13 in 2011 (p = 0.09) which was not statistically significant.
Plodr 2016	Before/After	326	Not defined; "Time from call	Median times to cardiac arrest recognition were 46 s before the new protocol (PER 1) and 37 s after the

			to..." measurements**	new protocol (PER2) (p = 0.002), to first compression 2 min 35 s in PER1 and 2 min 25 s in PER2 (p = 0.549). Admission to hospital with return of spontaneous circulation (ROSC) was achieved in 39 patients (31.9%) in PER1 and 57 (45.6%) in PER2 (p < 0.05), discharge from hospital (CPC 1–2) in 9.0% and 14.4% patients in PER1 and PER2, respectively. If ventricular fibrillation was the initial rhythm, survival rate (CPC 1–2) was not statistically different at 32.3% in PER1 and 38.7% in PER2 (p = 0.523).
Rasmussen 2017	Randomized Mannikin Simulation	125	Composite score*	The novel protocol (n = 61) improved CPR quality score (a composite endpoint of time to first compression, hand position, compression depth and rate and hands-off time; maximum score of 22 points) compared with the standard protocol (n = 64) (mean (SD): 18.6 (1.4)) points vs. 17.5 (1.7) points, p < 0.001. The novel protocol resulted in deeper chest compressions (mean (SD): 58 (12) mm vs. 52 (13) mm, p = 0.02) and improved rate of correct hand position (61% vs. 36%, p = 0.01) compared with the standard protocol. In both protocols hands-off time was short. The novel protocol improved motivation among rescuers (p = 0.002).
Ong 2022	Non-randomised Implementation Trial	170,687	Survival to hospital discharge/30-days	Comparing between groups, the comprehensive group had significantly higher change in BCPR (comprehensive vs control ratio of OR 1.86, 95% CI [1.66–2.09]; basic vs control ratio of OR 0.94, 95% CI [0.85–1.05]; and comprehensive vs basic ratio of OR 1.97, 95% CI [1.87–2.08]); survival with favorable neurological outcome (comprehensive vs basic ratio of OR 1.2, 95% CI [1.04–1.39])

Table 1h: Terminology Changes

***chest compression rate, depth, and the proportion of compressions without error, with correct hand position, adequate depth, and total release"

Study	Study Design	Sample	Primary Outcome	Main Findings
Brown 2008	Randomized Mannikin Simulation	215	Compression quality***	Instructions to ‘‘put the phone down’’ had no effect on the quality of bystander-initiated dispatcher-assisted CPR.
Mirza 2008	Secondary data analysis from RCTs	332	Compression quality***	Subjects were randomized to either modified Medical Priority Dispatch System (MPDS) v11.2 protocol or a new simplified protocol. Instructions to ‘‘push as hard as you can’’, compared to ‘‘push down firmly 2 in. (5 cm)’’, resulted in improved chest compression depth (36.4mm vs. 29.7mm, p < 0.0001), and improved median proportion of chest compressions done to the correct depth (32% vs. <1%, p < 0.0001). No significant difference in median proportion of compressions with total

				release (100% for both) and average compression rate (99.7 min vs. 97.5 min, p < 0.56) found.
Rodriguez 2014	Randomized Mannikin Simulation (Paediatrics)	128	Compression depth	Randomized to: (1) “Push as hard as you can” (PUSHHARD) or (2) “Push approximately 2 inches” (TWOINCHES) and do CPR on a simulated, 6-year-old pediatric manikin. The average CC depth (mean (SEM)) was greater in PUSH HARD compared to TWO INCHES (43 (1) vs. 36 (1) mm, p < 0.01) and met AHA targets more often (39% (25/64) vs. 20% (13/64), p = 0.02). CC rates trended higher in the PUSH HARD group (93 (4) vs. 82 (4) CC/min, p = 0.06). More providers did not achieve full chest recoil with PUSH HARD compared to TWO INCHES (53% (34/64) vs. 75% (48/64), p = 0.01).
Riou 2018	Telephone record review	424	Caller agreement to perform CPR	Caller agreement was low (43%) when dispatchers used terms of willingness (“do you want to do CPR?”). Caller agreement was high (97% and 84% respectively) when dispatchers talked about CPR in terms of futurity (“we are going to do CPR”) or obligation (“we need to do CPR”). In 38% (25/66) of calls where the caller initially declined CPR, the dispatcher eventually secured their agreement by making several attempts at initiating CPR.
Trethewey 2019	Randomized Mannikin Simulation	330	Compression depth	Participants were randomized to ‘at least 5 cm’ (n = 109), ‘approximately 5 cm’ (n = 110) and ‘hard and fast’ (n = 111), in which mean chest compression depth was 40.9 mm (SD 13.8), 35.4 mm (SD 14.1), and 46.8 mm (SD 15.0) respectively. Mean difference in chest compression depth between ‘at least 5 cm’ and ‘approximately 5 cm’ was 5.45 (95% confidence interval (95% CI) 0.78–10.12), between ‘hard and fast’ and ‘approximately 5 cm’ was 11.32 (95% CI 6.65–15.99), and between ‘hard and fast’ and ‘at least 5 cm’ was 5.87 (95% CI 1.21– 10.53). Chest compression rate and count were both highest in the ‘hard and fast’ group.
Leong 2021	Telephone record review	1296	Time from call to first compression	Standard protocol involves the instruction ‘push 100 times a minute 5 cm deep’ versus initiative where the instruction was simplified to ‘push hard and fast’. Time to first compression was 238.62 seconds and 218.83 seconds in the ‘before’ and ‘after’ groups, respectively (p = 0.016). In the per-protocol analysis, the interval between instruction and compression was 37.19 seconds, 28.31 seconds and 32.40 seconds in the standard protocol, simplified protocol and ‘own words’ groups, respectively (p = 0.005).

Table 2i: Undress instructions

Study	Study Design	Sample	Primary Outcome	Main Findings
Eisenberg-Chavez 2013	Randomized Mannikin Study	99	Time from call to first compression	Time to first compression was 109s among the instruction to remove clothing group and 79s among those randomized to forgo clothing removal, ($p < 0.001$). Among those randomized to remove clothing instructions, mean compression depth was 41mm, compression rate was 97 per minute, and the percentage with complete compression release was 95%. Among those randomized to forgo clothing removal instruction, mean compression depth was 40mm, compression rate was 99 per minute, and the percentage with complete compression release was 91% ($p > 0.05$ for each CPR metric comparison).

Table 2j: Verbal encouragement

Study	Study Design	Sample	Primary Outcome	Main Findings
Hwang 2020	Randomized Mannikin Simulation	72	Compression rate and depth	Compared to standard DA-instructions, ongoing encouragement from dispatchers resulted in improved compression rate but no change in chest compression depth.

Table 2k: Video vs. Audio-only calls

***chest compression rate, depth, and the proportion of compressions without error, with correct hand position, adequate depth, and total release"

Study	Study Design	Sample	Primary Outcome	Main Findings
Johnsen 2008	Qualitative after simulated calls	6	N/A (Qualitative)	Video-calls influenced the information basis and understanding of the dispatchers. The dispatchers experienced that (1) video-calls are useful for obtaining information and provides adequate functionality to support CPR assistance; (2) their CPR assistance becomes easier; (3) the CPR might be of better quality; but (4) there is a risk of ‘‘noise’’.
Bolle 2009	Randomized Mannikin Simulation (HS Students)	180	Not defined; "time to" and compression quality	The median CPR time without chest compression (‘hands-off time’) was shorter in the video-call group vs. the audio-call group (303 vs. 331 s; P=0.048), but the median time to first compression was not shorter (104 vs. 102 s; P50.29). The median time to first ventilation was insignificantly shorter in the video-call group (176 vs. 205 s; P50.16). This group also had a slightly higher proportion of ventilations without error (0.11 vs. 0.06; P50.30).
Yang 2009	Randomized Mannikin Simulation	96	Compression quality***	Chest compressions among the video group were faster (median rate 95.5 vs. 63.0 min1, $p < 0.01$), deeper (median depth 36.0 vs. 25.0 mm, $p < 0.01$), and of more appropriate depth (20.0% vs. 0%, $p < 0.01$). The video group had more “hands-off” time (5.0 vs. 0 second, $p < 0.01$), longer time to first chest compression (145.0 vs. 116.0 seconds, $p < 0.01$) and

				total instruction time (150.0 vs. 121.0 seconds, p < 0.01).
Lee 2011	Randomized Mannikin Simulation	138	Not defined; Compression quality***	For the video group, the chest compression rate was more optimal (99.5 min?1 vs. 77.4 min?1, P < 0.01) and the time from the initial phone call to the first compressions was shorter (184 s vs. 211 s, P < 0.01). The depth of compressions was deeper in the audio group (31.3mm vs. 27.5mm, P = 0.21), but neither group performed the recommended depth of compression. The hand positions for compression were more appropriate in the video group (71.8% vs. 43.6%, P = 0.01). As many as 71.8% of the video group had no 'hands-off' events when performing compression (vs. 46.2% for the audio group, P = 0.02).
Lee 2020	Retrospective Cohort Registry study	1720	Survival to hospital discharge	A total of 1720 eligible OHCA patients (1489 and 231 in the audio and video groups, respectively) were evaluated. The median ITI was 136 s in the audio group and 122 s in the video group (p = 0.12). The survival to discharge rates were 8.9% in the audio group and 14.3% in the video groups (p < 0.01). Good neurological outcome occurred in 5.8% and 10.4% in the audio and video groups, respectively (p < 0.01). Compared to the audio group, the AORs (95% CIs) for survival to discharge, good neurological outcome and early ITI of the video group were 1.20 (0.74-1.94), 1.28 (0.73-2.26) and 1.00 (0.70-1.43), respectively.
Kim 2021	Exploratory sequential MMR	24	Not defined: Overall CPR Performance	Video-based instruction was found to be more effective in the number of chest compressions (p < 0.01), chest compression rate (p < 0.01), and chest compression interruptions (p<0.01). The accuracy of the video group for the chest compression region was high (p = 0:05). Participants' qualitative experiences were divided into three categories: ``unfamiliar but beneficial experience,'' ``met helper during a desperate and embarrassing situation,'' and ``diverse views on drone use.''
Lee 2021	Randomized Mannikin Simulation	131	Mean proportion of adequate hand positioning	The mean proportion of adequate hand positioning was highest in V-DACPR with rapid transition (V-DACPR with rapid transition vs. C-DACPR: 92.7% vs. 82.4%, p = 0.03). The mean chest compression depth was deeper in both V-DACPR groups than in the C-DACPR group (V-DACPR with rapid transition vs. C-DACPR: 40.7 mm vs. 35.9 mm, p = 0.01, V-DACPR with delayed transition vs. C- DACPR: 40.9 mm vs. 35.9 mm, p = 0.01). Improvement in the proportion of adequate hand positioning was observed in the V-DACPR groups (r = 0.25, p < 0.01 for rapid transition and r = 0.19, p < 0.01 for delayed transition).
Linderoth 2021	Retrospective Cohort study	52	CPR quality	Improvements following video-assisted instruction to correct hand position (55.6% to 72.2%, p<0.001), compression rate (50% to 74.4%, p<0.001), and compression depth (21.1% to 30.0%, p<0.001). No difference in chest recoil (63.3% to 61.1%).

Peters 2022	Randomized Mannikin Simulation	120	Overall CPR Performance Score	Of 255 candidates assessed for eligibility, 120 subjects were randomly assigned to 1 of the 4 following groups: untrained telephone-guided (U-T; n = 30) or video-guided (U-V; n = 30) groups and trained telephone-guided (T-T; n = 30) or video-guided (T-V; n = 30) groups. Cardiac arrest was appropriately identified in 86.7% of the U-T group and in 100% in the other groups (P = 0.0061). Hand positioning was adequate in 76.7% of T-T, 80% of T-V, and 60% of U-V, as compared with 23.4% of the U-T group (P = 0.0001). Fewer volunteers managed to deliver 2 rescue breaths/cycle (P = 0.0001) in the U-T (16.7%) compared with the U-V (43.3%), the T-T (56.7%), and the T-V groups (60%). Subjects in the video groups had a lower fraction of minute to ventilate as compared with the telephone groups (P = 0.0005).